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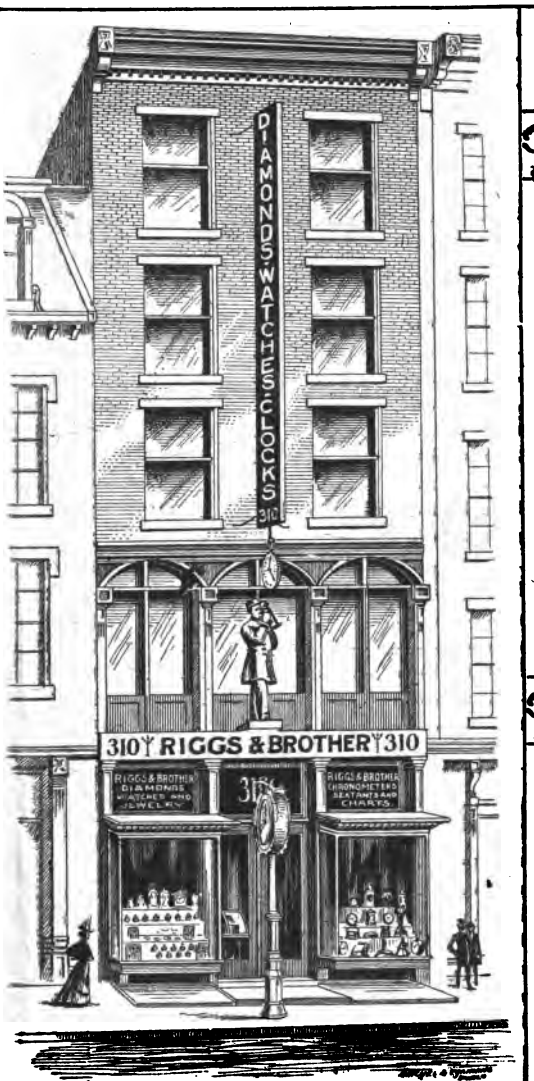
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1901

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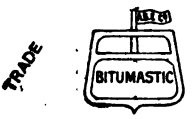

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NOTICE TO MARINERS

A branch of the United States Hydrographic Office is maintained in the **Philadelphia Bourse, 4th Street above Chestnut,** with a Naval Officer in charge.

This office has, corrected to date, copies of all publications of the Hydrographic Office, U. S. Coast and Geodetic Survey and the Light-House Board, also Harbor, Coast and General Charts.

Light and Buoy Books and Notices to Mariners are distributed without cost.

Barometers and Thermometers are compared with the Standards free of cost, and the latest information can always be obtained regarding charts, lights, dangers to navigation, and all matters of interest to mariners.

Navigators of all nationalities are invited to avail themselves of the benefits of this office and to co-operate with the Hydrographic Office at the Navy Department in Washington by sending in prompt and complete reports of marine data upon their arrival in port, including gales, wrecks, derelicts and all dangers to navigation.

A time ball, operated by this office, is dropped from the roof of the **Philadelphia Bourse** at noon, seventy-fifth Meridian Time corresponding to 5-00-00 P. M., Greenwich Mean Time.

T. A. POTTS,
Lieut. Commander, U. S. Navy,
In charge.

Tidal Indicator in Delaware River, Delaware

The position of the tidal indicator established on the northern end of the ice breaker at Reedy Island Quarantine Station is shown on the charts.

The indicator appears as a large semicircle painted white, and faces up stream. The inner edge of the semicircle is divided into spaces by heavy black lines representing feet and half-feet. The longer of these division lines are numbered by figures in black.

A pointer, actuated by the rise and fall of the tide, turning about the center of the circle, sweeps along the inner edge of the graduations and indicates, at any moment, the number of feet of water above or below the plane of reference (mean low water) to which soundings on the charts are reduced. The minus sign, shown near the left edge of the indicator, indicates the number of feet below the plane of reference.

An arrowhead, placed in the center of the disk, is made to point up while the tide is rising and down while it is falling. A glance at the indicator will enable the navigator to tell the height of the tide, whether above or below mean low water, and whether it be rising or falling.

The division lines, figures, pointer, and arrowhead can readily be seen at the distance of about a mile with the aid of an ordinary marine glass.

The ebb and flood currents in the vicinity continue to flow for quite a period after the water has begun to rise or fall. The arrowhead indicates whether the water is actually rising or falling, regardless of the direction in which the current may be running at the time.

The tide tables, published annually by this office, give the times and heights of the tides for each day, but these may be greatly modified by meteorological disturbances that can not be foreseen and can not enter as elements in the calculation of the tables. The predictions taken from the tide tables may not, therefore, represent the actual condition of the tides. The tidal indicator, however, shows the actual state of the tide at all times.

Outward-bound vessels, when about a mile above, should be able to read the indicator with the aid of an ordinary marine glass, observe the stage of tide, and note whether it be rising or falling.

Should it be found that a vessel is too deeply laden to cross Baker Shoal at the stage of tide indicated, she will have sufficient time to anchor before the indicator is reached, and be in a position from which it may be watched until it shows that the shoal may be safely passed.

The cut shown herewith will enable anyone to understand the operation of the indicator. It shows a falling tide at 1¼ feet above the plane of reference.

W. W. DUFFIELD,
Superintendent U. S. C. and G. Survey.

Measured Mile for Speed Trials

A course of exactly one statute mile (of 5280 feet) has been laid off on the New Jersey side of the Delaware River at Deep Water Point, by the Harlan & Hollingsworth Co. Each end of the course is marked by two upright range poles, painted white, with black balls on top. The upper or northerly range poles are at Deep Water Point, and are 371 feet apart; the lower, or southerly range poles are 260 feet apart; the bearing of the mile course between the two ranges is S. W. by S. ½ S. magnetic, and the distance one statute mile of 5280 feet.

1 Statute Mile = 5280 feet.
1 Nautical Mile, or Knot = 6080 feet.

List of Ship-Building Yards, Dry Docks, Marine Railways and Engineering Works on the Delaware River

The Wm. Cramp & Sons Ship and Engine Building Company	Philadelphia
The Penn Works, Neafie & Levy	Philadelphia
The Delaware River Engineering and Iron Ship-Building Yard, Wm. Roach	Chester, Pa.
The Harlan & Hollingsworth Co., Iron Ship Building Yard	Wilmington, Del.
Pusey, Jones & Company	Wilmington, Del.
The Jackson & Sharp Co	Wilmington, Del.
Samuel W. Tilton	Camden, N. J.
Morris & Mathius	Camden, N. J.
John Dialogue	Camden, N. J.
New York Ship Building Company	Camden, N. J.

(Furnished by the U. S. Coast and Geodetic Survey.)

TIDE TABLE.

Showing time of High Water at 109 Stations on the Atlantic Coast by differences from Philadelphia, Penna. To find the time of High Water at any of the following ports, apply the correction set opposite the port to the time of High Water at Philadelphia on the date wanted.

Example: Find the time of the High Waters at Fernandina, Florida, on July 4, 1901.

From the table for Philadelphia it is seen that the high waters there on July 4, 1901, occur at 3:08 a. m., and 3:31 p. m., which increased by 5:50 the tabular difference for Fernandina, gives 8:58 a. m. and 9:21 p. m. as the required times.

Time of High Water at Philadelphia will be found on page 16-17.

		H.	M.	Mean Range of Tides in Feet.
Eastport, Maine	Subtract	3	05	18.2
Machiasport, Maine	"	3	10	13.5
Bar Harbor, Maine	"	3	15	11.1
Fort Point, Penobscot River, Maine	"	2	33	10.1
Muscle Ridge Channel, Maine	"	3	01	9.4
Portland, Maine	"	2	55	8.8
Portsmouth, N. H.	"	2	36	9.2
Gloucester, Mass.	"	2	57	8.9
Salem, Mass.	"	2	42	9.2
Marblehead, Mass.	"	2	50	9.2
Lynn Harbor, Mass.	"	2	38	9.5
Boston, Mass.	"	2	31	9.6
Boston Light, Mass.	"	2	49	9.5
Plymouth, Mass.	"	2	40	10.2
Chatham, Cape Cod, Mass.	"	1	51	4.0
Provincetown Harbor, Cape Cod, Mass.	"	2	32	9.2
Monomoy Point, Mass.	"	2	02	3.7
Pollock Rip, Mass.	"	2	12	4.1
Hyannis Mass.	"	1	38	3.1
Nantucket, Mass.	"	1	33	3.0
Gay Head, Mass.	Add	5	57	3.0
Cuttyhunk, Mass.	"	6	03	3.5
New Bedford, Mass.	"	6	24	4.2
Newport, R. I.	"	6	16	3.5
Providence, R. I.	"	6	41	4.4
Point Judith, R. I.	"	6	01	3.1
Block Island, R. I.	"	6	02	3.0
Montauk Point, N. Y.	"	6	51	1.9
New London, Conn.	Subtract	4	27	2.4
New Haven, Conn.	"	2	41	6.0
New Rochelle, N. Y.	"	2	33	7.6
Hell Gate, New York	"	3	45	5.1
Brooklyn Navy Yard, New York	"	5	01	4.4
Governor's Island, New York	Add	6	44	4.4
Sandy Hook, N. J.	"	6	10	4.6
Long Branch, N. J.	"	6	20	4.4
Asbury Park, N. J.	"	6	23	4.2
Sea Girt, N. J.	"	6	25	4.0
Barnegat Inlet, N. J.	"	6	30	2.2
Toms River, N. J.	Subtract	2	57	0.7
Cedar Creek, N. J.	"	4	26	1.0
New Inlet, N. J.	Add	6	29	3.5
Little Egg Harbor, N. J.	Subtract	4	24	2.3
Great Bay, N. J.	"	5	14	2.8
Atlantic City, N. J.	Add	6	29	4.2
Absecon Bay, N. J.	Subtract	3	44	3.9
Great Egg Inlet, N. J.	Add	6	25	4.3
Corson Inlet, N. J.	"	6	23	4.3
Sea Isle City, N. J.	"	6	21	4.2

		H.	M.	Mean Range of Tides in Feet.
Townsend Inlet, N. J.	Add	6	20	4.2
Hereford Inlet, N. J	"	6	17	4.3
Sewell's Point, N. J	"	6	19	4.4
Port Richmond Elevator, Del. River, Phila., Pa	"	0	15	5.6
Cooper's Point, Del. River, Phila., Pa	"	0	12	5.8
Walnut Street Wharf, Delaware River	"	0	06	6.0
Kaighn's Point, Delaware River	Subtract	0	02	
Greenwich Point, Delaware River	"	0	09	6.0
League Island Navy Yard, Delaware River	"	0	22	6.1
Chestnut Street Wharf, Schuylkill River	"	0	01	6.0
Gibson's Point, Schuylkill River	"	0	12	6.0
Point Breeze, Schuylkill River	"	0	15	6.1
Girard Point, Schuylkill River	"	0	24	6.2
Essington, Delaware River	"	1	00	6.2
Chester, Delaware River	"	1	09	6.3
Schooner Ledge, Delaware River	"	1	12	6.0
Pennsylvania Quarantine Station, Delaware River	"	1	17	6.2
Marcus Hook Reporting Station, Delaware River	"	1	17	6.2
Cherry Island Flats, Delaware River	"	1	43	6.2
Wilmington (Ent. Christiana Creek) Delaware River	"	1	39	5.8
Deep Water Point, Delaware River	"	1	47	6.5
Newcastle Reporting Station, Delaware River	"	1	54	6.4
Fort Delaware, Delaware River	"	2	19	6.3
Delaware City, Delaware River	"	2	19	6.3
Reedy Island Reporting Station, Delaware River	"	2	43	6.4
Liston's Point, Delaware River	"	3	24	6.2
Bombay Hook Light, Delaware River	"	3	33	6.2
Ship John Light House, Delaware River	"	4	10	6.0
Mahon's River Light House, Delaware River	"	4	31	5.8
Cross Ledge Light House, Delaware River	"	4	42	5.8
Maurice River Light House	"	4	41	5.7
Fourteen Foot Bank Light House, Delaware River	"	4	58	4.7
Brandywine Shoal Light House, Delaware River	"	5	11	4.5
Cape Henlopen, Delaware	Add'	7	01	4.5
Delaware Breakwater Reporting Station, Del. River	"	7	00	4.4
Cape May City, N. J	"	6	41	4.5
North East End Light Vessel	"	6	15	
Five Fathom Bank Light Vessel	"	6	06	
Chincoteague, Virginia	"	6	24	2.8
Cape Charles, Virginia	"	6	51	2.5
Cape Henry, Virginia	"	6	41	2.7
Old Point Comfort, Virginia	Subtract	4	52	2.5
Norfolk Navy Yard, Virginia	"	4	31	2.7
Newport News, Virginia	"	4	43	2.6
Annapolis, Maryland	Add	3	29	0.9
Baltimore, Maryland	"	5	17	1.2
Back Creek Entrance, Maryland	Subtract	4	43	2.1
Havre de Grace, Maryland	"	4	00	2.0
Hatteras Inlet, N. C	Add	5	51	2.0
Cape Lookout, N. C	"	5	19	3.7
Beaufort, N. C.	"	6	12	2.8
Cape Fear, N. C	"	6	22	4.3
Wilmington, N. C	Subtract	3	37	2.4
Charleston, S. C	Add	6	25	5.1
Port Royal, S. C	"	7	05	7.1
Savannah Entrance, Georgia	"	6	18	6.8
Sapelo Light House, Doboy Sound, Ga	"	6	40	7.2
Fernandina, Florida	"	5	50	5.9
St. John's River, Florida	"	5	47	4.6
Key West, Florida	"	7	32	1.2

Eastern Standard Time—Five Hours Slower than Greenwich Time.

TIME OF HIGH WATER AT PHILADELPHIA, PA., 1901.— Washington Street Wharf.

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DATE.	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	A. M.	P. M.	A. M.	P. M.	A. M.	P. M	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	10 22	10 48	11 56	.....	10 42	11 07	11 57	.....	.....	0 10	0 44	1 03
2	11 21	11 45	0 18	0 45	11 34	11 58	0 24	0 42	0 35	0 54	1 24	1 46
3	.....	0 12	1 08	1 32	.....	0 21	1 05	1 24	1 16	1 35	2 06	2 26
4	0 38	1 04	1 56	2 18	0 48	1 08	1 46	2 04	1 56	2 16	2 47	3 07
5	1 31	1 53	2 42	3 00	1 34	1 53	2 27	2 44	2 35	2 53	3 28	3 52
6	2 18	2 38	3 26	3 43	2 16	2 32	3 03	3 21	3 12	3 34	4 14	4 40
7	3 06	3 26	4 08	4 24	2 57	3 12	3 43	3 57	3 54	4 15	5 00	5 21
8	3 54	4 12	4 52	5 03	3 36	3 51	4 22	4 38	4 38	4 56	5 52	6 17
9	4 40	4 56	5 34	5 44	4 15	4 28	5 05	5 22	5 24	5 45	6 41	7 14
10	5 26	5 38	6 16	6 27	4 54	5 08	5 51	6 12	6 14	6 37	7 38	8 14
11	6 14	6 24	7 03	7 13	5 37	5 54	6 38	7 12	7 05	7 34	8 35	9 12
12	7 00	7 10	7 51	8 06	6 24	6 38	7 34	7 54	8 01	8 33	9 37	10 14
13	7 48	7 58	8 44	9 01	7 14	7 27	8 32	8 57	9 01	9 34	10 35	11 12
14	8 37	8 48	9 37	9 57	8 07	8 27	9 30	9 58	10 01	10 34	11 34	.....
15	9 27	9 42	10 31	10 52	9 02	9 25	10 25	10 55	11 01	11 33	0 14	0 30
16	10 14	10 34	11 24	11 46	10 00	10 24	11 24	11 53	11 57	.....	0 58	1 24
17	11 04	11 26	.....	0 14	10 56	11 20	.....	0 21	0 24	0 52	1 50	2 15
18	11 52	.....	0 38	1 06	11 48	.....	0 46	1 12	1 16	1 43	2 40	3 06
19	0 14	0 42	1 28	1 56	0 14	0 44	1 37	2 04	2 08	2 34	3 28	3 57
20	1 05	1 32	2 24	2 45	1 06	1 34	2 28	2 54	3 00	3 26	4 18	4 48
21	1 53	2 17	3 10	3 33	1 58	2 25	3 22	3 46	3 52	4 18	5 07	5 40
22	2 42	3 06	4 00	4 24	2 50	3 17	4 14	4 38	4 44	5 13	5 57	6 32
23	3 31	3 54	4 53	5 17	3 42	4 06	5 07	5 35	5 35	6 07	6 47	7 24
24	4 23	4 45	5 48	6 12	4 35	4 58	6 01	6 30	6 28	7 04	7 38	8 16
25	5 14	5 35	6 46	7 10	5 28	5 53	6 58	7 31	7 24	7 58	8 30	9 06
26	6 08	6 30	7 47	8 10	6 26	6 52	7 56	8 28	8 16	8 54	9 20	9 54
27	7 07	7 28	8 45	9 12	7 24	7 51	8 54	9 25	9 08	9 45	10 10	10 41
28	8 07	8 28	9 45	10 10	8 24	8 51	9 46	10 18	10 00	10 34	10 58	11 26
29	9 06	9 30			9 22	9 50	10 37	11 08	10 50	11 17	11 46	.....
30	10 04	10 28			10 18	10 45	11 27	11 54	11 37	11 59	0 05	0 31
31	11 01	11 27			11 08	11 35			.....	0 20		

MEAN RANGE OF TIDES AT PHILADELPHIA—6 FEET.

Eastern Standard Time—Five Hours Slower than Greenwich Time.

TIME OF HIGH WATER AT PHILADELPHIA, PA., 1901.— Washington Street Wharf.

Furnished by U. S. Coast and Geodetic Survey Office.

DATE.	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	A. M.	P. M.	A. M.	P. M.	A. M	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	0 52	1 17	1 58	2 21	3 07	3 34	3 35	4 02	5 04	5 32	5 40	6 03
2	1 41	2 00	2 44	3 07	3 57	4 24	4 26	4 57	6 00	6 27	6 36	6 56
3	2 24	2 44	3 31	3 54	4 48	5 17	5 20	5 51	7 00	7 25	7 32	7 50
4	3 08	3 31	4 18	4 44	5 43	6 14	6 18	6 50	7 58	8 24	8 26	8 44
5	3 52	4 15	5 07	5 37	6 38	7 14	7 18	7 48	8 55	9 18	9 20	9 37
6	4 40	5 04	5 58	6 32	7 38	8 14	8 20	8 50	9 52	10 14	10 12	10 28
7	5 27	5 57	6 57	7 37	8 42	9 15	9 22	9 50	10 44	11 04	11 00	11 16
8	6 21	6 55	7 56	8 34	9 42	10 15	10 17	10 44	11 31	11 50	11 43	.....
9	7 15	7 54	8 58	9 34	10 42	11 11	11 10	11 34	.....	0 15	0 03	0 25
10	8 16	8 54	9 59	10 35	11 36	.....	11 58	.....	0 34	0 57	0 47	1 08
11	9 17	9 54	10 58	11 28	0 03	0 26	0 22	0 44	1 16	1 38	1 28	1 48
12	10 17	10 52	11 55	.....	0 50	1 14	1 06	1 27	1 57	2 16	2 08	2 28
13	11 16	11 46	0 22	0 46	1 36	1 57	1 45	2 08	2 37	2 57	2 50	3 12
14	.....	0 12	1 12	1 37	2 16	2 40	2 25	2 48	3 18	3 38	3 31	3 56
15	0 40	1 06	1 59	2 24	2 57	3 22	3 05	3 22	3 57	4 17	4 17	4 40
16	1 31	1 57	2 44	3 08	3 39	4 02	3 45	4 04	4 40	5 02	5 00	5 24
17	2 20	2 47	3 27	3 54	4 17	4 41	4 22	4 45	5 22	5 48	5 48	6 12
18	3 08	3 35	4 00	4 36	4 57	5 24	5 06	5 30	6 12	6 38	6 43	7 04
19	3 54	4 22	4 48	5 20	5 37	6 07	5 46	6 17	7 16	7 30	7 39	8 00
20	4 38	5 09	5 28	6 01	6 23	6 56	6 37	7 06	8 03	8 27	8 37	8 57
21	5 24	5 57	6 16	6 47	7 12	7 47	7 32	8 00	9 01	9 25	9 37	10 00
22	6 08	6 47	7 00	7 34	8 08	8 40	8 26	8 58	9 58	10 27	10 37	11 00
23	6 57	7 34	7 51	8 25	9 06	9 35	9 27	9 54	10 58	11 23	11 34	11 58
24	7 45	8 24	8 47	9 18	10 13	10 32	10 26	10 52	11 55	.....	.....	0 27
25	8 37	9 12	9 41	10 12	11 00	11 24	11 20	11 50	0 18	0 50	0 54	1 21
26	9 28	10 04	10 35	11 05	11 54	.....	.....	0 16	1 14	1 42	1 46	2 12
27	10 18	10 51	11 28	11 55	0 17	0 42	0 43	1 08	2 06	2 32	2 38	3 04
28	11 12	11 40	.....	0 20	1 12	1 33	1 34	2 00	2 57	3 24	3 31	3 52
29	.....	0 01	0 44	1 08	2 00	2 24	2 24	2 52	3 52	4 17	4 22	4 44
30	0 28	0 47	1 32	1 57	2 50	3 13	3 16	3 44	4 44	5 08	5 15	5 33
31	1 14	1 34	2 20	2 44			4 10	4 37			6 07	6 23

FOR ADDITIONAL TIDE TABLES SEE PAGES 14=15.

Distance and Tide Table for the Delaware River

(Prepared by the United States Coast and Geodetic Survey)

This table gives, in first column, the distance of the following places from Washington Avenue Wharf, Philadelphia; in the second column the distances from place to place. The time of High Water at any place may be found by applying the correction found in third column to the time of High Water at Philadelphia for the date wanted.

(For time of High Water at Philadelphia, see page 16–17.)

	Nautical Miles.	Nautical Miles.	Correction for Tides. + Signifies Add. — Signifies Subtract.	h.	m.
Port Richmond Elevator, Philadelphia	3.30	1.60	+		15
Coopers Point, N. J. { off Fairmount Ave., Phila.	1.70	0.25	+		12
Coopers Point, N. J. { off Callowhill St., Phila.	1.45	0.65			
Walnut St. Wharf, Philadelphia	0.80	0.80	+		06
Washington Ave. Wharf, Phila. (foot of Wash. Ave.)	0.00				
Kaighn's Point, N. J. (off Reed St., Philadelphia)	0.22	0.22	—		02
Greenwich Point, Phila., (off lower R. R. dock)	1.62	1.40	—		09
League Island Navy Yard, (off center of dock)	4.52	2.90	—		22
Girard Point, Philadelphia	6.27	1.75	—		24
Point Breeze Oil Works Schuylkill River (off upper end of wharf)	8.67	2.40	—		15
Gibson's Point, Schuylkill River (off upper end of wharf	9.77	1.10	—		12
Chestnut St. Wharf, Schuylkill River	12.17	2.40	—		01
Opposite Essington, Pa. (on line with Dupont wharf)	10 50		—	1	00
Chester, Pa. (Market St. Wharf)	13 30	2 80	—	1	09
Schooner Ledge, Delaware River (between buoys)	15 10	1 80	—	1	12
Marcus Hook, Pa., (off principal street)	18 30	3 20	—	1	17
Cherry Island Flats (at junction of range, off Edgemoor)	24 10	5 80	—	1	43
Wilmington, Del., entrance to Christiana Creek (on range with light)	25 90	1 80	—	1	39
Deep Water Point, N. J. (on line with W. & N. R. R. Wharf)	26.85	0.95	—	1	47
Newcastle, Del. (on line with Kelly's Point)	30.10	3.25	—	1	54
Fort Delaware (wharf beam)	34.40	4.30	—	2	19
Reedy Island (off Tide Indicator)	39.20	4.80	—	2	43
Liston's Point (abeam)	45.00	5.80	—	3	24
Bombay Hook Light (abeam)	48.25	3.25	—	3	33
Ship John Light (abeam)	54.90	6.65	—	4	10
Cross Ledge Light (abeam)	65.40	10.50	—	4	42
Maurice River Light (abeam)	68.70	3.30	—	4	41
Fourteen Foot Bank Light (abeam)	72.50	3 80	—	4	54
Brandywine Shoal Light (abeam)	77.30	4.80	—	5	11
Cape Henlopen (north end of Cape abeam)	88.00	10.70	+	7	01
Overfalls Light Vessel	89.10	1.10	+	7	00
Five Fathom Bank Light Vessel	110.00	20.90	+	6	06
Northeast End Light Vessel	121.00	11.00	+	6	15
From Washington Ave. Wharf, Phila., to Cape May, N. J. (Bay Shore Wharf) via Ricords Channel	85.8				
To Cape Henlopen (north end of Cape)	88.5				
From Cape Henlopen to Cape May (Bay Shore Wharf) via through Channel	10.4				

	COURSE	DISTANCE
From Overfalls Light Ship to Five Fathom Bank Light Ship	E. ¼ S.	20.9 Nau. Miles
From Five Fathom Bank Light Ship to N. E. End Light Ship	N. N. E. ⅜ E.	11.0 " "

AVERAGE DURATION AND HEIGHT OF TIDES.

	Duration. *Rise.* h. m.	*Fall.* h. m.	*Height.* *Spring Tides.*	*Neap Tides.*	*Average Tides.*
Philadelphia	5.07	7.18	7.0 feet.	5.0 feet.	6.0 feet.
New Castle	5.16	7.09	7.5 "	5 4 "	6.5 "
Delaware Breakwater	6.20	6.05	5.3 "	3.4 "	4.4 "

Compass Variation at Philadelphia, 7° Westerly.

COMPARATIVE LINEAL MEASURE

Table Showing Draft of Foreign Vessels Reduced to English Feet

AUSTRIAN		DANISH AND NORWEGIAN		FRENCH		GERMAN		HOLLAND	
Vienna	English	Danish	English	French	English	Hamburg	English	Amsterdam	English
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
0 3	0 3.1	0 3	0 3.1	0 3	0 3.3	0 3	0 2.9	0 3	0 3.1
0 6	0 6.2	0 6	0 6.2	0 6	0 6.5	0 6	0 5.7	0 6	0 6.2
0 9	0 9.3	0 9	0 9.2	0 9	0 9.8	0 9	0 8.6	0 9	0 9.3
1 0	1 0.4	1 0	1 0.3	1 0	1 1.1	1 0	0 11.5	1 0	1 0.3
2 0	2 0.9	2 0	2 0.6	2 0	2 2.2	2 0	1 11.0	2 0	2 0.7
3 0	3 1.3	3 0	3 1.0	3 0	3 3.3	3 0	2 10.5	3 0	3 1.0
4 0	4 1.8	4 0	4 1.3	4 0	4 4.4	4 0	3 10.0	4 0	4 1.3
5 0	5 2.2	5 0	5 1.6	5 0	5 5.6	5 0	4 9.5	5 0	5 1.7
6 0	6 2.7	6 0	6 2.0	6 0	6 6.7	6 0	5 9.0	6 0	6 2.1
7 0	7 3.1	7 0	7 2.3	7 0	7 7.8	7 0	6 8.5	7 0	7 2.4
8 0	8 3.6	8 0	8 2.6	8 0	8 9.0	8 0	7 8.0	8 0	8 2.7
9 0	9 4.0	9 0	9 2.9	9 0	9 10.1	9 0	8 7.5	9 0	9 3.1
10 0	10 4.5	10 0	10 3.2	10 0	10 11.2	10 0	9 7.0	10 0	10 3.4
11 0	11 4.9	11 0	11 3.6	11 0	12 0.3	11 0	10 6.5	11 0	11 3.8
12 0	12 5.3	12 0	12 3.9	12 0	13 1.5	12 0	11 6.0	12 0	12 4.1
13 0	13 5.8	13 0	13 4.2	13 0	14 2.5	13 0	12 5.5	13 0	13 4.4
14 0	14 6.2	14 0	14 4.5	14 0	15 3.6	14 0	13 5.0	14 0	14 4.8
15 0	15 6.7	15 0	15 4.8	15 0	16 4.7	15 0	14 4.5	15 0	15 5.1
16 0	16 7.1	16 0	16 5.2	16 0	17 5.9	16 0	15 4.0	16 0	16 5.5
17 0	17 7.6	17 0	17 5.5	17 0	18 7.0	17 0	16 3.5	17 0	17 5.8
18 0	18 8.0	18 0	18 5.8	18 0	19 8.1	18 0	17 3.0	18 0	18 6.2
19 0	19 8.5	19 0	19 6.2	19 0	20 9.3	19 0	18 2.5	19 0	19 6.6
20 0	20 8.9	20 0	20 6.4	20 0	21 10.4	20 0	19 2.0	20 0	20 7.0
21 0	21 9.3	21 0	21 6.8	21 0	22 11.5	21 0	20 1.5	21 0	21 7.4
22 0	22 9.8	22 0	22 7.1	22 0	24 0.6	22 0	21 1.0	22 0	22 7.8
23 0	23 10.2	23 0	23 7.4	23 0	25 1.7	23 0	22 0.5	23 0	23 8.2
24 0	24 10.7	24 0	24 7.8	24 0	26 2.9	24 0	23 0.0	24 0	24 8.6

GREEK & ITALIAN [*Old Standard*]		PORTUGUESE		RUSSIAN		SPANISH		SWEDISH	
Greek & Italian	English	Portuguese	English	Russian	English	Madrid	English	Carlscrona	English
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
0 3	0 3.4	0 3	0 3.3	0 3	0 3.2	0 3	0 2.8	0 3	0 3.0
0 6	0 6.8	0 6	0 6.5	0 6	0 6.4	0 6	0 5.6	0 6	0 6.0
0 9	0 10.3	0 9	0 10.8	0 9	0 9.6	0 9	0 8.3	0 9	0 8.9
1 0	1 1.7	1 0	1 0.9	1 0	1 1.7	1 0	0 11.1	1 0	0 11.9
2 0	2 3.4	2 0	2 1.8	2 0	2 3.5	2 0	1 10.2	2 0	1 11.8
3 0	3 5.0	3 0	3 2.8	3 0	3 5.2	3 0	2 9.4	3 0	2 11.7
4 0	4 6.7	4 0	4 3.7	4 0	4 7.0	4 0	3 8.5	4 0	3 11.6
5 0	5 8.4	5 0	5 4.7	5 0	5 8.7	5 0	4 7.6	5 0	4 11.6
6 0	6 10.1	6 0	6 5.6	6 0	6 10.5	6 0	5 6.8	6 0	5 11.5
7 0	7 11.7	7 0	7 6.5	7 0	8 0.2	7 0	6 5.9	7 0	6 11.4
8 0	9 1.4	8 0	8 7.5	8 0	9 2.0	8 0	7 5.0	8 0	7 11.3
9 0	10 3.1	9 0	9 8.4	9 0	10 3.7	9 0	8 4.2	9 0	8 11.2
10 0	11 4.8	10 0	10 9.4	10 0	11 5.5	10 0	9 3.3	10 0	9 11.1
11 0	12 6.4	11 0	11 10.3	11 0	12 7.2	11 0	10 2.4	11 0	10 11.9
12 0	13 8.1	12 0	12 11.2	12 0	13 9.0	12 0	11 1.5	12 0	11 10.9
13 0	14 9.8	13 0	14 0.2	13 0	14 10.7	13 0	12 0.7	13 0	12 10.8
14 0	15 11.5	14 0	15 1.1	14 0	16 0.5	14 0	12 11.0	14 0	13 10.8
15 0	17 1.2	15 0	16 2.1	15 0	17 2.2	15 0	13 10.9	15 0	14 10.7
16 0	18 2.8	16 0	17 3.0	16 0	18 4.0	16 0	14 10.3	16 0	15 10.6
17 0	19 4.5	17 0	18 3.9	17 0	19 5.7	17 0	15 9.2	17 0	16 10.5
18 0	20 6.2	18 0	19 4.9	18 0	20 7.5	18 0	16 8 3	18 0	17 10.4
19 0	21 7.9	19 0	20 5.8	19 0	21 9.2	19 0	17 7.4	19 0	18 10.3
20 0	22 9.5	20 0	21 6.8	20 0	22 11.0	20 0	18 6.6	20 0	19 10.2
21 0	23 11.2	21 0	22 7.7	21 0	24 0.7	21 0	19 5.7	21 0	20 10.1
22 0	25 0.9	22 0	23 8.6	22 0	25 2.5	22 0	20 4.8	22 0	21 10.0
23 0	26 2.6	23 0	24 9.6	23 0	26 4.2	23 0	21 3.9	23 0	22 10.0
24 0	27 4.3	24 0	25 10.5	24 0	27 6.0	24 0	22 3.1	24 0	23 10.9

Belgian measure is the same as French. Large Bremen and Russian ships are usually marked in English feet; Dutch, Antwerp and German generally with Rhineland measure; Finland with Swedish; Austrian with Italian measure. Greek and Italian Lineal measure is now same as French.

USE OF THE BAROMETER.

Commonly familiar as the practical use of the barometer as a weather-glass is at sea, as well as on land, only those who have long watched its indications and compared them carefully, are really able to conclude more than that a rising glass (column) usually foretells less wind or rain, a falling column (glass) more wind or rain, or both; a high column fine weather, and a low one the reverse. But useful as are these general conclusions, *in most cases*, they are *sometimes* erroneous, and then depreciating remarks are rather hastily made, tending to discourage the inexperienced.

By attending to the following brief observations (the results of many years' practice and persons' experience), any one not accustomed to use a barometer may do so with less hesitation and with immediate advantage:

The column of mercury in a good barometer usually stands, on an *average*, some tenths of an inch higher, with or *before* polar and easterly winds, than it does with or before equatorial and westerly winds (of equal strength and dryness or moisture) in all parts of the oceans.

(The terms polar and equatorial are used with reference to winds blowing from the *nearest* polar direction, or from the direction of the equator).

This peculiarity causes many mistakes.

The glass is high, perhaps, but falling. Wind or rain, or both, are expected in consequence, yet neither follow to any remarkable degree. A change of wind only from one quarter to another takes place. Reversely, the glass is low, but rising. Fine weather is expected; yet, instead of that, a *strong* wind, accompanied perhaps by rain, hail, or snow, rises from the polar direction. By such changes as these, seamen are often misled, and much calamity occurs sometimes.

An impending fall of rain or snow affects the barometer, wind still more (having regard to the quarter whence it blows and the *average* difference).

There may be heavy rains, or violent winds, beyond the horizon, and even the view of an observer, by which his instruments may be affected considerably, though no particular change of weather occurs in his immediate locality.

Sometimes severe weather from an equatorial (southerly in north latitude, northerly in the southern hemisphere) direction, not lasting long, may cause no great fall of the glass, because followed by a *duration* of wind from polar regions; and at times the column may fall considerably with polar winds and fine weather, apparently against the rule (or law), because a *continuance* of equatorial winds is about to follow.

There is little variation of the barometer between the tropics, because the wind blows generally in the same direction and with equal force, and no contending currents of air cause any considerable change in the temperature or density of the atmosphere. For great storms or hurricanes, however, within the tropics, the barometer falls very low, but soon returns to its usual state.

It has been observed on some coasts that the barometer is differently affected by the wind, according as it blows from the sea or from the land, the mercury rising on the approach of the sea breeze, and falling previously to the setting in of the land wind.

Some young seamen hardly appreciate sufficiently common rules about weather, which are as true as they are trite; namely, that a red sky at sunset presages fine weather; a red sky in the morning bad weather, or much wind, if not rain; a gray sky in the morning, fine weather; that soft-looking or delicate clouds foretell fine weather, with moderate or light breezes; hard-edged, oily-looking clouds, wind; that a dark, gloomy, blue sky is windy, but a light, bright blue sky indicates fine weather; that, generally, the softer the clouds look the less wind (but perhaps the more rain) may be expected; and the harder, more "greasy," rolled, tufted, or ragged, the stronger the wind will prove. Also that a bright yellow sky at sunset presages wind; a pale yellow, wet; and that by the preponderance of red, yellow or gray tints the coming weather may be foretold very nearly—indeed, if aided by instruments, almost accurately.

These indications of weather, afforded by colors, seem to deserve more critical study than has yet been given to the subject.

Why a rosy hue at sunset, or a gray, neutral tint at that time, should presage the reverse of their indications at sunrise ; why bright yellow should foretell wind at either time, and pale yellow, wet ; why clouds seem soft, like water-color, or hard-edged, like oil paint, or Indian ink, or an oily plate, and why such appearances are infallible signs, are yet to be shown satisfactorily.

THE WEATHER GLASS.

The barometer rises for northerly wind (including from the northwest, by the *north*, to the eastward), for dry or less wet weather ; for less wind, or for more than one of these changes, except on a few occasions, when rain, hail or snow comes from the northward with *strong* wind.

The barometer falls for southerly wind (including from the southeast, by the *south*, to the westward), for wet weather ; for stronger wind, or for more than one of these changes, except on a few occasions, when *moderate* wind with rain (or snow) comes from the northward.

Rise for northeasterly, NW., N., E. ; dry or less wind, except wet from northeastward.

Fall for southwesterly, SE., S., W. ; wet or more wind, except wet from northeastward.

"When rise begins after low,
Squalls expect and clear blow.

Long foretold—long last,
Short notice—soon past.

First rise after low
Foretells stronger blow."

"When the glass falls low,
Prepare for a blow ;
When it rises high,
Let all your kites fly."

These rules will suit the southern hemisphere exactly, if we put N. for S. and S. for N. throughout.

"First the rain and then the wind,
Topsail sheets and halyards mind ;
But when the wind's before the rain
Hoist the topsails up again."

"When wind comes before rain,
Soon you will make sail again ;
When rain comes before wind,
Halyards, sheets and braces mind."

"Mackerel skies and mares' tails
Make tall ships carry low sails."

"A rainbow in the morning
Is the sailor's warning ;
A rainbow at night
Is the shepherd's delight."

"When the sun sets in a clear,
An easterly wind you need not fear."

SUN'S RIGHT ASCENSION, 1901

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	h m s	h m s	h m s	h m s	h m s	h m s	h m s	h m s	h m s	h m s	h m s	h m s
1	18 45 20.05	20 57 44.82	22 47 1.26	0 40 42.70	2 31 57.11	4 34 35.77	6 38 49.92	8 43 43.82	10 39 52.41	12 27 54.86	14 23 58.94	16 27 33.14
2	18 49 44 88	21 1 49.18	22 50 45.87	0 44 21.08	2 35 46 09	4 38 41.21	6 42 57.97	8 47 36.74	10 43 30.07	12 31 32.19	14 27 54.07	16 31 52.27
3	18 54 9.35	21 5 52.69	22 54 29.98	0 47 59.55	2 39 35.60	4 42 47.04	6 47 5.76	8 51 29.08	10 47 7.45	12 35 9.84	14 31 50.03	16 36 12.05
4	18 58 33.44	21 9 55.40	22 58 13.60	0 51 38.16	2 43 25.65	4 46 53.25	6 51 13.27	8 55 20.81	10 50 44.58	12 38 47.82	14 35 46.83	16 40 32.46
5	19 2 57.12	21 13 57.29	23 1 56.76	0 55 16.93	2 47 16.26	4 50 59.83	6 55 20.48	8 59 11.96	10 54 21.48	12 42 26.17	14 39 44.46	16 44 53.48
6	19 7 20.38	21 17 58.37	23 5 39.48	0 58 55.88	2 51 7.44	4 55 6.76	6 59 27.39	9 3 2.54	10 57 58.16	12 46 4.90	14 43 42.94	16 49 15.07
7	19 11 43.19	21 21 58.64	23 9 21.77	1 2 35.04	2 54 59.19	4 59 14.02	7 3 33.97	9 6 52.54	11 1 34.64	12 49 44.02	14 47 42.26	16 53 37 21
8	19 16 5.52	21 25 58.14	23 13 3.67	1 6 14.41	2 58 51.52	5 3 21.61	7 7 40.19	9 10 41.97	11 5 10.94	12 53 23.56	14 51 42.44	16 57 59.87
9	19 20 27 34	21 29 56.85	23 16 45.20	1 9 54.02	3 2 44.43	5 7 29.49	7 11 46.06	9 14 30.83	11 8 47.08	12 57 3.54	14 55 43.47	17 2 23.02
10	19 24 48.65	21 33 54.79	23 20 26.37	1 13 33.90	3 6 37 93	5 11 37.66	7 15 51.55	9 18 19.13	11 12 23.07	13 0 43.97	14 59 45.34	17 6 46.63
11	19 29 9.40	21 37 51.96	23 24 7.21	1 17 14.05	3 10 32.03	5 15 46.09	7 19 56.65	9 22 6.87	11 15 58.92	13 4 24.86	15 3 48.08	17 11 10 66
12	19 33 29.59	21 41 48.37	23 27 47.74	1 20 54 51	3 14 26.72	5 19 54.76	7 24 1.33	9 25 54.06	11 19 34.66	13 8 6.24	15 7 51.66	17 15 35.08
13	19 37 49.19	21 45 44.04	23 31 27.99	1 24 35.28	3 18 22.01	5 24 3.65	7 28 5.57	9 29 40.69	11 23 10.30	13 11 48.11	15 11 56.08	17 19 59.87
14	19 42 8 18	21 49 38.97	23 35 7.96	1 28 16.39	3 22 17.89	5 28 12.72	7 32 9.36	9 33 26.77	11 26 45.84	13 15 30.50	15 16 1.35	17 24 24 98
15	19 46 26.54	21 53 33.17	23 38 47.70	1 31 57.85	3 26 14.37	5 32 21.96	7 36 12.68	9 37 12.31	11 30 21.32	13 19 13.42	15 20 7.46	17 28 50 38
16	19 50 44.24	21 57 26.66	23 42 27.20	1 35 39 66	3 30 11.42	5 36 31.33	7 40 15.51	9 40 57.31	11 33 56.75	13 22.56.88	15 24 14.39	17 33 16 02
17	19 55 1.26	22 1 19.44	23 46 6.50	1 39 21.86	3 34 9.06	5 40 40.80	7 44 17.83	9 44 41.77	11 37 32.14	13 26 40.90	15 28 22.16	17 37 41 89
18	19 59 17.60	22 5 11.52	23 49 45.61	1 43 4.43	3 38 7.26	5 44 50.36	7 48 19.62	9 48 25.72	11 41 7.51	13 30 25.49	15 32 30.75	17 42 7.94
19	20 3 33.22	22 9 2.90	23 53 24.55	1 46 47.40	3 42 6.02	5 48 59.96	7 52 20.87	9 52 9.14	11 44 42.88	13 34 10.67	15 36 40.14	17 46 34.13
20	20 7 48.12	22 12 53.61	23 57 3.34	1 50 30.77	3 46 5.33	5 53 9.59	7 56 21.57	9 55 52.06	11 48 18.27	13 37 56.46	15 40 50.34	17 51 0.43
21	20 12 2.26	22 16 43.64	0 0 41.98	1 54 14.55	3 50 5.17	5 57 19.21	8 0 21.70	9 59 34.48	11 51 53.70	13 41 42.86	15 45 1.34	17 55 26.81
22	20 16 15.65	22 20 33.01	0 4 20.50	1 57 58.75	3 54 5.54	6 1 28.79	8 4 21.25	10 3 16.42	11 55 29.19	13 45 29.90	15 49 13.11	17 59 53 24
23	20 20 28.25	22 24 21.74	0 7 58.91	2 1 43.38	3 58 6.42	6 5 38.33	8 8 20.22	10 6 57.88	11 59 4.76	13 49 17.60	15 53 25.67	18 4 19.69
24	20 24 40.05	22 28 9.82	0 11 37.23	2 5 28.45	4 2 7.80	6 9 47.79	8 12 18.60	10 10 38.90	12 2 40.42	13 53 5.96	15 57 39.00	18 8 46.12
25	20 28 51.05	22 31 57.29	0 15 15.47	2 9 13.95	4 6 9.68	6 13 57.14	8 16 16.38	10 14 19.46	12 6 16.20	13 56 55.00	16 1 53.09	18 13 12.50
26	20 33 1.22	22 35 44.14	0 18 53.65	2 12 59.94	4 10 12.04	6 18 6.37	8 20 13.55	10 17 59.60	12 9 52.14	14 0 44.74	16 6 7.94	18 17 38.82
27	20 37 10.58	22 39 30.41	0 22 31.80	2 16 46 38	4 14 14.88	6 22 15.46	8 24 10.12	10 21 39.32	12 13 28.25	14 4 35.20	16 10 23.53	18 22 5.03
28	20 41 19.10	22 43 16.11	0 26 9.93	2 20 33 32	4 18 18.17	6 26 24.38	8 28 6.08	10 25 18.65	12 17 4.55	14 8 26.40	16 14 39.86	18 26 31.11
29	20 45 26.78		0 29 48.07	2 24 20.74	4 22 21.92	6 30 33.10	8 32 1.43	10 28 57.59	12 20 41.07	14 12 18 36	16 18 56.92	18 30 57.04
30	20 49 33.63		0 33 26.22	2 28 8.67	4 26 26.11	6 34 41.62	8 35 56.16	10 32 36.20	12 24 17.83	14 16 11.10	16 23 14.68	18 35 22.78
31	20 53 39.65		0 37 4.43		4 30 30.73		8 39 50.30	10 36 14.46		14 20 4.62		18 39 48.29

Phases of the Moon for 1901

GREENWICH MEAN TIME

JANUARY

	d.	h.	m.
○ Full Moon	4	12	13.5
☾ Last Quarter	12	8	38.2
● New Moon	20	2	35.8
☽ First Quarter	26	21	52.2

FEBRUARY

	d.	h.	m.
○ Full Moon	3	3	29.8
☾ Last Quarter	11	6	12.0
● New Moon	18	14	45.2
☽ First Quarter	25	6	38.2

MARCH

	d.	h.	m.
○ Full Moon	4	20	4.4
☾ Last Quarter	13	1	6.2
● New Moon	20	0	53.0
☽ First Quarter	26	16	38 9

APRIL

	d.	h.	m.
○ Full Moon	3	13	20.2
☾ Last Quarter	11	15	57.1
● New Moon	18	9	37.4
☽ First Quarter	25	4	14.9

MAY

	d.	h.	m.
○ Full Moon	3	6	18.9
☾ Last Quarter	11	2	38.0
● New Moon	17	17	37.6
☽ First Quarter	24	17	39.6

JUNE

	d.	h.	m.
○ Full Moon	1	21	52.7
☾ Last Quarter	9	9	59.9
● New Moon	16	1	32.9
☽ First Quarter	23	8	58.9

JULY

	d.	h.	m.
○ Full Moon	1	11	17.6
☾ Last Quarter	8	15	19.9
● New Moon	15	10	10.5
☽ First Quarter	23	1	58.2
○ Full Moon	30	22	33.7

AUGUST

	d.	h.	m.
☾ Last Quarter	6	20	1.9
● New Moon	13	20	27.5
☽ First Quarter	21	19	52.0
○ Full Moon	29	8	21.1

SEPTEMBER

	d.	h.	m.
☾ Last Quarter	5	1	27.2
● New Moon	12	9	18.5
☽ First Quarter	20	13	33.3
○ Full Moon	27	17	35.7

OCTOBER

	d.	h.	m.
☾ Last Quarter	4	8	52.2
● New Moon	12	1	11.3
☽ First Quarter	20	5	57.6
○ Full Moon	27	3	6.3

NOVEMBER

	d.	h.	m.
☾ Last Quarter.	2	19	24.4
● New Moon	10	19	34.2
☽ First Quarter	18	20	23.4
○ Full Moon	25	13	17.6

DECEMBER

	d.	h.	m.
☾ Last Quarter	2	9	49.5
● New Moon	10	14	53.1
☽ First Quarter	18	8	35.2
○ Full Moon	25	0	15.9

AT GREENWICH APPARENT NOON

JANUARY, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Tues.	1	S. 23 2 29.1	+11.95	3 34.07	1.185
Wed.	2	22 57 28.3	13.11	4 2.35	1.169
Thur.	3	22 52 0.1	14.26	4 30.28	1.154
Fri.	4	22 46 4.6	+15.39	4 57.81	1.138
Sat.	5	22 39 42.0	16.51	5 24.94	1.121
Sun.	6	22 32 52.4	17.63	5 51.65	1.103
Mon.	7	22 25 36.1	+18.74	6 17.90	1.083
Tues.	8	22 17 53.2	19.84	6 43.68	1.063
Wed.	9	22 9 44.0	20.94	7 8.95	1.042
Thur.	10	22 1 8.7	+22.02	7 33.71	1.020
Fri.	11	21 52 7.5	23.09	7 57.91	0.997
Sat.	12	21 42 40.7	24.15	8 21.55	0.972
Sun.	13	21 32 48.7	+25.20	8 44.60	0.947
Mon.	14	21 22 31.5	26.24	9 7.02	0.921
Tues.	15	21 11 49.7	27.26	9 28.83	0.894
Wed.	16	21 0 43.3	+28.27	9 49.97	0.867
Thur.	17	20 49 12.7	29.27	10 10.44	0.838
Fri.	18	20 37 18.6	30.25	10 30.22	0.809
Sat.	19	20 25 0.9	+31.23	10 49.29	0.779
Sun.	20	20 12 20.0	32.19	11 7.63	0.748
Mon.	21	19 59 16.5	33.12	11 25.21	0.717
Tues.	22	19 45 50.6	+34.04	11 42.03	0.685
Wed.	23	19 32 2.7	34.95	11 58.08	0.652
Thur.	24	19 17 53.2	35.84	12 13.32	0.618
Fri.	25	19 3 22.5	+36.72	12 27.75	0.584
Sat.	26	18 48 30.9	37.58	12 41.37	0.550
Sun.	27	18 33 18.9	38.43	12 54.16	0.516
Mon.	28	18 17 46.8	+39.26	13 6 12	0.481
Tues.	29	18 1 55.1	40.07	13 17.24	0.447
Wed.	30	17 45 44.0	40.86	13 27.53	0.412
Thur.	31	17 29 14.2	41.64	13 36.99	0.377

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AT GREENWICH APPARENT NOON

FEBRUARY, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Fri.	1	S. 17 12 25.7	+42.40	13 45.60	0.342
Sat.	2	16 55 19.0	43.14	13 53.40	0.307
Sun.	3	16 37 54.7	43.87	14 0.35	0.273
Mon.	4	16 20 12.9	+44.59	14 6.49	0.239
Tues.	5	16 2 14.3	45.29	14 11.81	0.205
Wed.	6	15 43 59.1	45.97	14 16.34	0.172
Thur.	7	15 25 27.6	+46.64	14 20.05	0.139
Fri.	8	15 6 40.4	47.29	14 22.99	0.106
Sat.	9	14 47 37.8	47.92	14 25.13	0.074
Sun.	10	14 28 20.3	+48.54	14 26.50	0.042
Mon.	11	14 8 48.3	49.13	14 27.11	0.010
Tues.	12	13 49 2.1	49.71	14 26.97	0.021
Wed.	13	13 29 2.2	+50.27	14 26.07	0.052
Thur.	14	13 8 49.1	50.82	14 24.45	0.083
Fri.	15	12 48 23.1	51.35	14 22.08	0.113
Sat.	16	12 27 44.6	+51.86	14 19.01	0.143
Sun.	17	12 6 54.2	52.35	14 15.22	0.172
Mon.	18	11 45 52.2	52.82	14 10.75	0.201
Tues.	19	11 24 39.1	+53.26	14 5.57	0.230
Wed.	20	11 3 15.3	53.69	13 59.71	0.258
Thur.	21	10 41 41.3	54.11	13 53.18	0.285
Fri.	22	10 19 57.5	+54.52	13 46.00	0.313
Sat.	23	9 58 4.3	54.90	13 38.16	0.340
Sun.	24	9 36 2.2	55.27	13 29.69	0.366
Mon.	25	9 13 51.4	+55.62	13 20.59	0.391
Tues.	26	8 51 32.6	55.95	13 10.89	0.416
Wed.	27	8 29 6.0	56.27	13 0.60	0.440
Thur.	28	8 6 32.0	56.57	12 49.75	0.463

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AT GREENWICH APPARENT NOON

MARCH, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Fri.	1	S. 7 43 50.9	+56.86	12 38.34	0.486
Sat.	2	7 21 3.4	57.11	12 26.41	0.508
Sun.	3	6 58 9.6	57.34	12 13.95	0.529
Mon.	4	6 35 9.9	+57.56	12 1.02	0.549
Tues.	5	6 12 4.7	57.78	11 47.63	0 568
Wed.	6	5 48 54.5	57.99	11 33.79	0.585
Thur.	7	5 25 39.5	+58.20	11 19.53	0.602
Fri.	8	5 2 20.0	58.38	11 4.88	0.618
Sat.	9	4 38 56.6	58.55	10 49.86	0.634
Sun.	10	4 15 29.5	+58.69	10 34.47	0.648
Mon.	11	3 51 59.3	58.82	10 18.76	0.661
Tues.	12	3 28 26.0	58.94	10 2.74	0.673
Wed.	13	3 4 50.3	+59.05	9 46.43	0.685
Thur.	14	2 41 12.4	59.13	9 29.86	0.696
Fri.	15	2 17 32.7	59.18	9 13.04	0.706
Sat.	16	1 53 51.6	+59.23	8 56.00	0.715
Sun.	17	1 30 9.6	59.27	8 38.75	0.723
Mon.	18	1 6 26.8	59.29	8 21.31	0.730
Tues.	19	0 42 43.8	+59.29	8 3.69	0.737
Wed.	20	S. 0 19 1.0	59.27	7 45.94	0.743
Thur.	21	N. 0 4 41.2	59.24	7 28.03	0.749
Fri.	22	0 28 22.5	+59.20	7 9.99	0.754
Sat.	23	0 52 2.5	59.14	6 51.86	0.758
Sun.	24	1 15 40.9	59.06	6 33 63	0.761
Mon.	25	1 39 17.1	+58.96	6 15.32	0.764
Tues.	26	2 2 50.8	58.85	5 56.96	0.766
Wed.	27	2 26 21.9	58.73	5 38.56	0.767
Thur.	28	2 49 49.9	+58.59	5 20.14	0.767
Fri.	29	3 13 14.4	58 44	5 1.73	0.767
Sat.	30	3 36 35.1	58.28	4 43.33	0.765
Sun.	31	3 59 51.7	58.10	4 24.99	0.763

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AT GREENWICH APPARENT NOON

APRIL, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to* / *Subtracted from Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Mon.	1	N. 4 23 3.8	+57.90	4 6.72	0.759
Tues.	2	4 46 11.1	57.70	3 48.54	0.755
Wed.	3	5 9 13.3	57.48	3 30.47	0.750
Thur.	4	5 32 10.1	+57.24	3 12.53	0.744
Fri.	5	5 55 1.0	57.00	2 54.76	0.737
Sat.	6	6 17 45.9	56.74	2 37.15	0.729
Sun.	7	6 40 24.4	+56.46	2 19.75	0.720
Mon.	8	7 2 56.0	56.17	2 2.58	0.711
Tues.	9	7 25 20.6	55.87	1 45.64	0.700
Wed.	10	7 47 37.8	+55.55	1 28.97	0.689
Thur.	11	8 9 47.2	55.22	1 12.57	0.677
Fri.	12	8 31 48.5	54.88	0 56.48	0.664
Sat.	13	8 53 41.3	+54.52	0 40.70	0.650
Sun.	14	9 15 25.4	54.15	0 25.26	0.636
Mon.	15	9 37 0.4	53.76	0 10.16	0.621
Tues.	16	9 58 25.8	+53.36	0 4.56	0.606
Wed.	17	10 19 41.4	52.94	0 18.90	0.591
Thur.	18	10 40 46.9	52.50	0 32.89	0.575
Fri.	19	11 1 41.7	+52.06	0 46.48	0.558
Sat.	20	11 22 25.8	51.60	0 59.66	0.541
Sun.	21	11 42 58.5	51.13	1 12.43	0.524
Mon.	22	12 3 19.6	+50.64	1 24.79	0.506
Tues.	23	12 23 28.8	50.13	1 36.71	0.488
Wed.	24	12 43 25.7	49.61	1 48.20	0.470
Thur.	25	13 3 10.1	+49.08	1 59.24	0.451
Fri.	26	13 22 41.5	48.54	2 9.82	0.431
Sat.	27	13 41 59.7	47.98	2 19.92	0.411
Sun.	28	14 1 4.4	+47.41	2 29.53	0.391
Mon.	29	14 19 55.2	46.83	2 38.67	0.370
Tues.	30	14 38 31.9	46.23	2 47.29	0.349

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AT GREENWICH APPARENT NOON

MAY, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Subtracted from Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Wed.	1	N.14 56 54.1	+45.62	2 55.40	0.327
Thur.	2	15 15 1.5	45.00	3 2.98	0.305
Fri.	3	15 32 53.9	44.36	3 10.03	0.282
Sat.	4	15 50 30.8	+43.71	3 16.54	0.259
Sun.	5	16 7 52.1	43.06	3 22.48	0.236
Mon.	6	16 24 57.4	42.39	3 27.85	0.212
Tues.	7	16 41 46.3	+41.70	3 32.66	0.188
Wed.	8	16 58 18.7	41.00	3 36.89	0.164
Thur.	9	17 14 34.2	40.29	3 40.53	0.140
Fri.	10	17 30 32.5	+39.57	3 43.58	0.115
Sat.	11	17 46 13.4	38.83	3 46.05	0.090
Sun.	12	18 1 36.5	38.08	3 47.92	0.065
Mon.	13	18 16 41.5	+37.32	3 49.18	0.040
Tues.	14	18 31 28.2	36.55	3 49.86	0.016
Wed.	15	18 45 56.1	35.77	3 49.93	0.009
Thur.	16	19 0 5.2	+34.98	3 49.43	0.033
Fri.	17	19 13 55.0	34.17	3 48.35	0.057
Sat.	18	19 27 25.3	33.36	3 46.72	0.080
Sun.	19	19 40 35.8	+32.54	3 44.51	0.103
Mon.	20	19 53 26.2	31.69	3 41.76	0.126
Tues.	21	20 5 56.3	30.82	3 38.47	0.148
Wed.	22	20 18 5.8	+29.95	3 34.66	0.169
Thur.	23	20 29 54.4	29.08	3 30.34	0.190
Fri.	24	20 41 22.0	28.20	3 25.51	0.211
Sat.	25	20 52 28.3	+27.31	3 20.19	0.232
Sun.	26	21 3 13.0	26.41	3 14.39	0.252
Mon.	27	21 13 35.9	25.49	3 8.12	0.271
Tues.	28	21 23 36.9	+24.57	3 1.38	0.290
Wed.	29	21 33 15.7	23.65	2 54.18	0.309
Thur.	30	21 42 32.2	22.72	2 46.55	0.327
Fri.	31	21 51 26.0	21.77	2 38.49	0.345

	CHRONOMETER of G. M. T.				Rate	
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AT GREENWICH APPARENT NOON

JUNE, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Subtracted from* / *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Sat.	1	N.21 59 57.1	+20.82	2 30.01	0 362
Sun.	2	22 8 5.2	19.86	2 21.11	0 378
Mon.	3	22 15 50.3	18.89	2 11.84	0.394
Tues.	4	22 23 12.0	+17.91	2 2.18	0.410
Wed.	5	22 30 10.3	16.93	1 52.16	0.425
Thur.	6	22 36 45.1	15.95	1 41.79	0.439
Fri.	7	22 42 55.9	+14.96	1 31.08	0.453
Sat.	8	22 48 43.0	13.96	1 20.05	0.466
Sun.	9	22 54 6.1	12.96	1 8.73	0.478
Mon.	10	22 59 5.0	+11.95	0 57.12	0.489
Tues.	11	23 3 39.7	10.94	0 45.24	0.500
Wed.	12	23 7 50.0	9.92	0 33.12	0.509
Thur.	13	23 11 36.0	+ 8.90	0 20.79	0.518
Fri.	14	23 14 57.3	7.88	0 8.27	0.525
Sat.	15	23 17 54.1	6.85	0 4.40	0.530
Sun.	16	23 20 26.2	+ 5.82	0 17.22	0.535
Mon.	17	23 22 33.6	4.79	0 30.14	0.540
Tues.	18	23 24 16.3	3.76	0 43.15	0.543
Wed.	19	23 25 34.3	+ 2.73	0 56.19	0.544
Thur.	20	23 26 27.4	1.70	1 9.26	0.544
Fri.	21	23 26 55.8	+ 0.67	1 22.33	0 544
Sat.	22	23 26 59.4	— 0.37	1 35.36	0.542
Sun.	23	23 26 38.2	1.40	1 48.34	0.539
Mon.	24	23 25 52.1	2.43	2 1.24	0.535
Tues.	25	23 24 41.5	— 3.46	2 14.04	0.531
Wed.	26	23 23 6.1	4.49	2 26.71	0.525
Thur.	27	23 21 6.1	5.51	2 39.24	0.518
Fri.	28	23 18 41.4	— 6.54	2 51.61	0.511
Sat.	29	23 15 52.3	7.56	3 3.78	0.503
Sun.	30	23 12 38.5	8.58	3 15.74	0.494

CHRONOMETER of G. M. T.					Rate	
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AT GREENWICH APPARENT NOON

JULY, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Mon.	1	N.23 9 0.4	— 9.59	3 27.48	0.484
Tues.	2	23 4 58.2	10.60	3 38.98	0.474
Wed.	3	23 0 31.6	11.60	3 50.21	0.462
Thur.	4	22 55 41.0	—12.61	4 1.16	0.450
Fri.	5	22 50 26.2	13.61	4 11.82	0.438
Sat.	6	22 44 47.7	14.60	4 22.17	0.425
Sun.	7	22 38 45.4	—15.59	4 32.20	0.410
Mon.	8	22 32 19.5	16.57	4 41.86	0.395
Tues.	9	22 25 30.2	17.55	4 51.17	0.380
Wed.	10	22 18 17.4	—18.52	5 0.11	0.364
Thur.	11	22 10 41.7	19.47	5 8.65	0.347
Fri.	12	22 2 43.0	20.42	5 16.77	0.329
Sat.	13	21 54 21.6	—21.37	5 24.46	0.310
Sun.	14	21 45 37.5	22.30	5 31.69	0.291
Mon.	15	21 36 31.2	23.23	5 38.44	0.271
Tues.	16	21 27 2.8	—24.15	5 44.71	0.251
Wed.	17	21 17 12.5	25.05	5 50.48	0.229
Thur.	18	21 7 0.5	25.94	5 55.71	0.207
Fri.	19	20 56 27.1	—26.83	6 0.40	0.184
Sat.	20	20 45 32.6	27.71	6 4.54	0.161
Sun.	21	20 34 17.1	28.57	6 8.11	0.137
Mon.	22	20 22 41.0	—29.42	6 11.11	0.113
Tues.	23	20 10 44.4	30.27	6 13.53	0.088
Wed.	24	19 58 27.7	31.10	6 15 35	0.063
Thur.	25	19 45 51.0	—31.93	6 16.57	0.038
Fri.	26	19 32 54.6	32.75	6 17.19	0.013
Sat.	27	19 19 38.8	33.55	6 17.18	0.013
Sun.	28	19 6 3.8	—34.34	6 16.58	0.038
Mon.	29	18 52 10.0	35.13	6 15.38	0.064
Tues.	30	18 37 57.6	35.90	6 13.56	0.089
Wed.	31	18 23 26.8	36.66	6 11.13	0.114

	CHRONOMETER of G. M. T.				Rate	
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AT GREENWICH APPARENT NOON

AUGUST, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour	CHRONOMETER of G. M. T.	Rate
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Thur.	1	N.18 8 37.9	—37.41	6 8.09	0.138	1	
Fri.	2	17 53 31.1	38.14	6 4.46	0.163	2	
Sat.	3	17 38 6.8	38.87	6 0.24	0.188	3	
Sun.	4	17 22 25.3	—39.59	5 55.42	0.213	4	
Mon.	5	17 6 26.7	40.29	5 50.01	0.237	5	
Tues.	6	16 50 11.3	40.98	5 44.03	0.261	6	
Wed.	7	16 33 39.6	—41.66	5 37.47	0.285	7	
Thur.	8	16 16 51.7	42.32	5 30.35	0.309	8	
Fri.	9	15 59 48.2	42.97	5 22.65	0.332	9	
Sat.	10	15 42 29.0	—43.60	5 14.40	0.356	10	
Sun.	11	15 24 54.6	44.22	5 5.59	0.379	11	
Mon.	12	15 7 5.5	44.84	4 56.22	0.402	12	
Tues.	13	14 49 1.8	—45.44	4 46.29	0.425	13	
Wed.	14	14 30 44.0	46.03	4 35.81	0.448	14	
Thur.	15	14 12 12.3	46.60	4 24.80	0.470	15	
Fri.	16	13 53 27.1	—47.15	4 13.24	0.493	16	
Sat.	17	13 34 28.6	47.69	4 1.15	0.515	17	
Sun.	18	13 15 17.3	48.23	3 48.54	0.537	18	
Mon.	19	12 55 53.5	—48.75	3 35.41	0.558	19	
Tues.	20	12 36 17.4	49.24	3 21.78	0.579	20	
Wed.	21	12 16 29.5	49.74	3 7.66	0.599	21	
Thur.	22	11 56 30.0	—50.21	2 53.04	0.619	22	
Fri.	23	11 36 19.2	50.67	2 37.94	0.638	23	
Sat.	24	11 15 57.4	51.13	2 22.41	0.657	24	
Sun.	25	10 55 25.0	—51.57	2 6.43	0.675	25	
Mon.	26	10 34 42.2	51.99	1 50.02	0.693	26	
Tues.	27	10 13 49.5	52.40	1 33.19	0.710	27	
Wed.	28	9 52 47.1	—52.80	1 15.96	0.726	28	
Thur.	29	9 31 35.1	53.19	0 58.36	0.741	29	
Fri.	30	9 10 14.2	53.56	0 40.42	0.755	30	
Sat.	31	8 48 44.4	53.92	0 22.14	0.769	31	

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AT GREENWICH APPARENT NOON

SEPTEMBER, 1901

Day of the Week.	Day of the Month.	THE SUN'S Apparent Declination.	Diff. for 1 hour.	Equation of Time to be *Added to* / *Subtracted from* Apparent Time.	Diff. for 1 hour
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Sun.	1	N. 8 27 6.0	—54.27	0 3.53	0.781
Mon.	2	8 5 19.4	54.60	0 15.35	0.793
Tues.	3	7 43 24.9	54.93	0 34.53	0.804
Wed.	4	7 21 22.8	—55.24	0 53.95	0.814
Thur.	5	6 59 13.4	55.54	1 13.59	0.823
Fri.	6	6 36 57.0	55.82	1 33.46	0.832
Sat.	7	6 14 34.2	—56.08	1 53.53	0.840
Sun.	8	5 52 4.9	56 34	2 13.77	0.847
Mon.	9	5 29 29.7	56.59	2 34.18	0.854
Tues.	10	5 6 48.9	—56.81	2 54.74	0.860
Wed.	11	4 44 2.9	57.02	3 15.43	0.865
Thur.	12	4 21 11.9	57.22	3 36.24	0.869
Fri.	13	3 58 16.4	—57.40	3 57.15	0.873
Sat.	14	3 35 16.7	57.57	4 18.16	0.877
Sun.	15	3 12 13.2	57.73	4 39.22	0.879
Mon.	16	2 49 6.1	—57.87	5 0.35	0.881
Tues.	17	2 25 55.9	57.99	5 21.50	0.882
Wed.	18	2 2 42.8	58.09	5 42.68	0.883
Thur.	19	1 39 27.3	—58.19	6 3.85	0.882
Fri.	20	1 16 9.6	58.27	6 25.01	0.881
Sat.	21	0 52 50.2	58.34	6 46.13	0.879
Sun.	22	0 29 29.1	—58.40	7 7.19	0.876
Mon.	23	N. 0 6 7.1	58.44	7 28.18	0.872
Tues.	24	S. 0 17 15.8	58.47	7 49.06	0.867
Wed.	25	0 40 39.1	—58.48	8 9.81	0.861
Thur.	26	1 4 2.6	58.48	8 30.42	0.855
Fri.	27	1 27 26.0	58.48	8 50.87	0.847
Sat.	28	1 50 49.0	—58.45	9 11.11	0.839
Sun.	29	2 14 11.1	58.41	9 31.14	0.829
Mon.	30	2 37 32.0	58.34	9 50.93	0.819

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AT GREENWICH APPARENT NOON

OCTOBER, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Subtracted from Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Tues.	1	S. 3 0 51.5	—58.27	10 10.45	0.807
Wed.	2	3 24 9.1	58.19	10 29.68	0.794
Thur.	3	3 47 24.6	58.10	10 48.58	0.780
Fri.	4	4 10 37.6	—57.99	11 7.14	0.766
Sat.	5	4 33 47.8	57.86	11 25.35	0.750
Sun.	6	4 56 54.7	57.71	11 43.17	0.734
Mon.	7	5 19 58.0	—57.55	12 0.60	0.717
Tues.	8	5 42 57.3	57.38	12 17.61	0.700
Wed.	9	6 5 52.2	57.20	12 34.18	0.681
Thur.	10	6 28 42.5	—56.99	12 50.31	0.662
Fri.	11	6 51 27.6	56.76	13 5.97	0.642
Sat.	12	7 14 7.0	56.52	13 21.14	0.622
Sun.	13	7 36 40.6	—56.26	13 35.82	0.601
Mon.	14	7 59 8.0	56.00	13 50.00	0.579
Tues.	15	8 21 28.6	55.71	14 3.63	0.557
Wed.	16	8 43 42.1	—55.41	14 16.73	0.534
Thur.	17	9 5 48.2	55.09	14 29.27	0.510
Fri.	18	9 27 46.4	54.75	14 41.23	0.486
Sat.	19	9 49 36.3	—54.40	14 52.61	0.461
Sun.	20	10 11 17.5	54.03	15 3.37	0.436
Mon.	21	10 32 49.8	53.65	15 13.53	0.410
Tues.	22	10 54 12.5	—53.25	15 23.05	0.383
Wed.	23	11 15 25.5	52.83	15 31.92	0.355
Thur.	24	11 36 28.3	52.39	15 40.11	0.327
Fri.	25	11 57 20.4	—51.94	15 47.63	0.298
Sat.	26	12 18 1.6	51.48	15 54.44	0.269
Sun.	27	12 38 31.4	50.99	16 0.54	0.238
Mon.	28	12 58 49.4	—50.49	16 5.91	0.207
Tues.	29	13 18 55.4	49.97	16 10.51	0.175
Wed.	30	13 38 48.9	49.44	16 14.34	0.143
Thur.	31	13 58 29.4	48.91	16 17.39	0.110

CHRONOMETER of G. M. T.				Rate	
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AT GREENWICH APPARENT NOON

NOVEMBER, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Subtracted from Apparent Time.*	Diff. for 1 hour
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Fri.	1	S.14 17 56.6	—48.35	16 19.63	0.076
Sat.	2	14 37 10.0	47.77	16 21.06	0.042
Sun.	3	14 56 9.6	47.17	16 21.66	0.007
Mon.	4	15 14 54.6	—46.56	16 21.43	0.027
Tues.	5	15 33 24.5	45.93	16 20.36	0.062
Wed.	6	15 51 39.1	45.28	16 18.45	0.097
Thur.	7	16 9 38.0	—44.61	16 15.69	0.133
Fri.	8	16 27 20.5	43.93	16 12.08	0.168
Sat.	9	16 44 46.5	43.23	16 7.61	0.204
Sun.	10	17 1 55.6	—42.51	16 2.30	0.240
Mon.	11	17 18 47.1	41.78	15 56.14	0.275
Tues.	12	17 35 21.2	41.03	15 49.11	0.310
Wed.	13	17 51 36.4	—40.26	15 41.25	0.345
Thur.	14	18 7 33.1	39.47	15 32.55	0.380
Fri.	15	18 23 10.9	38.67	15 23.00	0.415
Sat.	16	18 38 29.0	—37.85	15 12 63	0.450
Sun.	17	18 53 27.6	37.02	15 1.42	0.484
Mon.	18	19 8 5.8	36.17	14 49.40	0.518
Tues.	19	19 22 23.3	—35.30	14 36.58	0.551
Wed.	20	19 36 20.0	34.41	14 22.94	0.585
Thur.	21	19 49 55.2	33.51	14 8.50	0.618
Fri.	22	20 3 8.8	—32.60	13 53.28	0.651
Sat.	23	20 16 0.2	31.67	13 37.29	0.683
Sun.	24	20 28 29.2	30.73	13 20.52	0.715
Mon.	25	20 40 35.5	—29.78	13 2.98	0.746
Tues.	26	20 52 18.7	28.81	12 44.69	0.778
Wed.	27	21 3 38.4	27.83	12 25.66	0.809
Thur.	28	21 14 34.4	—26.83	12 5.89	0.839
Fri.	29	21 25 6.5	25.82	11 45 39	0.869
Sat.	30	21 35 14.1	24.80	11 24.18	0.898

	CHRONOMETER of G. M. T.				Rate	
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AT GREENWICH APPARENT NOON

DECEMBER, 1901

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Subtracted from* / *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Sun.	1	S. 21 44 56.9	—23.77	11 2.28	0.926
Mon.	2	21 54 15.0	22.73	10 39.71	0 954
Tues.	3	22 3 7.8	21.66	10 16.49	0.981
Wed.	4	22 11 35.0	—20.58	9 52.63	1.006
Thur.	5	22 19 36.4	19.50	9 28.16	1.031
Fri.	6	22 27 11.8	18.42	9 3.13	1.054
Sat.	7	22 34 21.0	—17.33	8 37.54	1.077
Sun.	8	22 41 3.6	16.22	8 11.43	1.097
Mon.	9	22 47 19.5	15.10	7 44.83	1.116
Tues.	10	22 53 8.5	—13.97	7 17.77	1.133
Wed.	11	22 58 30.3	12.84	6 50.29	1.150
Thur.	12	23 3 25.0	11.70	6 22.43	1.167
Fri.	13	23 7 52.0	—10.55	5 54.19	1.183
Sat.	14	23 11 51.5	9.40	5 25.62	1.196
Sun.	15	23 15 23.2	8.24	4 56.77	1.207
Mon.	16	23 18 27.1	— 7.07	4 27.67	1.217
Tues.	17	23 21 3.0	5.91	3 58.36	1.226
Wed.	18	23 23 10.8	4.74	3 28.84	1.232
Thur.	19	23 24 50.6	— 3.57	2 59.21	1.237
Fri.	20	23 26 2.1	2.39	2 29.46	1.241
Sat.	21	23 26 45.4	1.22	1 59.62	1.244
Sun.	22	23 27 0.4	— 0.04	1 29.74	1.245
Mon.	23	23 26 47.1	+ 1.14	0 59.85	1.245
Tues.	24	23 26 5.6	2.32	0 29.96	1.243
Wed.	25	23 24 55.7	+ 3.50	0 0.13	1.241
Thur.	26	23 23 17.6	4.68	0 29.65	1.237
Fri.	27	23 21 11.2	5.85	0 59.31	1.233
Sat.	28	23 18 36.6	+ 7.02	1 28.84	1.227
Sun.	29	23 15 33.9	8.19	1 58.22	1.220
Mon.	30	23 12 3.2	9.36	2 27.41	1.211
Tues.	31	23 8 4.6	10.52	2 56.38	1.202

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CALENDAR FOR 1902

AT GREENWICH APPARENT NOON

JANUARY, 1902

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Wed.	1	S.23 03 38.1	+11.68	3 25.09	1.192
Thur.	2	22 58 44.0	12.83	3 53.53	1.180
Fri.	3	22 53 22.3	13.98	4 21.66	1.166
Sat.	4	22 47 33.2	+15.11	4 49.41	1.149
Sun.	5	22 41 16.9	16.24	5 16.80	1.132
Mon.	6	22 34 33.6	17.36	5 43.77	1.115
Tues.	7	22 27 23.5	+18.48	6 10.31	1.096
Wed.	8	22 19 46.8	19.58	6 36 37	1.075
Thur.	9	22 11 43.7	20.68	7 01.93	1.054
Fri.	10	22 03 14.5	+21.76	7 26.96	1.031
Sat.	11	21 54 19.4	22.83	7 51.43	1.007
Sun.	12	21 44 58.8	23.89	8 15.31	0.982
Mon.	13	21 35 12.9	+24.94	8 38 59	0.956
Tues.	14	21 25 02.0	25.97	9 01.21	0.929
Wed.	15	21 14 26.3	27.00	9 23.17	0.901
Thur.	16	21 03 26.3	+28.01	9 44.46	0.872
Fri.	17	20 52 02.1	29.01	10 05.03	0.842
Sat.	18	20 40 14.2	29.99	10 24.88	0.812
Sun.	19	20 28 02.9	+30.96	10 44.00	0.781
Mon.	20	20 15 28.5	31.91	11 02.36	0.749
Tues.	21	20 02 31.2	32.86	11 19.96	0.717
Wed.	22	19 49 11.5	+33.78	11 36.79	0.685
Thur.	23	19 35 29.6	34.69	11 52.84	0.653
Fri.	24	19 21 26.1	35.59	12 08.11	0.620
Sat.	25	19 07 01.1	+36.48	12 22.59	0 588
Sun.	26	18 52 15.1	37.35	12 36.29	0.555
Mon.	27	18 37 08.3	38.20	12 49.20	0.522
Tues.	28	18 21 41.2	+39.04	13 01.30	0.488
Wed.	29	18 05 54.2	39.86	13 12.62	0.454
Thur.	30	17 49 47.7	40.67	13 23.12	0.421
Fri.	31	17 33 22.2	41.46	13 32.84	0.388

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CALENDAR FOR 1902

AT GREENWICH APPARENT NOON

FEBRUARY, 1902

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Sat.	1	S.17 16 37.8	+42.23	13 41.74	0.355
Sun.	2	16 59 35.1	42.99	13 49.84	0.321
Mon.	3	16 42 14.5	43.73	13 57.14	0.288
Tues.	4	16 24 36.3	+44.45	14 03.63	0.254
Wed.	5	16 06 41.0	45.15	14 09.31	0.220
Thur.	6	15 48 29.1	45.84	14 14.19	0.187
Fri.	7	15 30 00.9	+46.50	14 18.28	0.154
Sat.	8	15 11 17.0	47.15	14 21.56	0.120
Sun.	9	14 52 17.6	47.78	14 24.04	0.087
Mon.	10	14 33 03.4	+48.40	14 25.73	0.054
Tues.	11	14 13 34.6	48.99	14 26.63	0.021
Wed.	12	13 53 51.8	49.57	14 26.73	0.012
Thur.	13	13 33 55.3	+50.12	14 26.06	0.044
Fri.	14	13 13 45.6	50.67	14 24.62	0.076
Sat.	15	12 53 23.2	51.19	14 22.40	0.108
Sun.	16	12 32 48.3	+51.70	14 19.45	0.139
Mon.	17	12 12 01.6	52.19	14 15.74	0.169
Tues.	18	11 51 03.2	52.66	14 11.30	0.199
Wed.	19	11 29 53.7	+53.12	14 06.16	0.229
Thur.	20	11 08 33.5	53.56	14 00.31	0.257
Fri.	21	10 47 02.9	53.98	13 53.78	0.285
Sat.	22	10 25 22.2	+54.39	13 46.61	0.312
Sun.	23	10 03 31.9	54.78	13 38.79	0.339
Mon.	24	9 41 32.5	55.16	13 30.35	0.364
Tues.	25	9 19 24.3	+55.52	13 21.31	0.388
Wed.	26	8 57 07.6	55.86	13 11.70	0.412
Thur.	27	8 34 43.0	56.19	13 01.52	0.435
Fri.	28	8 12 10.5	56.50	12 50.80	0.457

CHRONOMETER of G. M. T.					Rate	
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CALENDAR FOR 1902

AT GREENWICH APPARENT NOON

MARCH, 1902

Day of the Week.	Day of the Month.	THE SUN'S *Apparent* Declination.	Diff. for 1 hour.	Equation of Time to be *Added to Apparent Time.*	Diff. for 1 hour
		° ′ ″	″	m s	s
Sat.	1	S. 7 49 30.9	+56.79	12 39.56	0.478
Sun.	2	7 26 44.4	57.07	12 27.82	0.499
Mon.	3	7 03 51.6	57.33	12 15.58	0.519
Tues.	4	6 40 52.5	+57.57	12 02.88	0.538
Wed.	5	6 17 47.9	57.80	11 49.73	0.557
Thur.	6	5 54 38.1	58.01	11 36.16	0.574
Fri.	7	5 31 23.3	+58.20	11 22.16	0.591
Sat.	8	5 08 04.1	58.38	11 07.77	0.607
Sun.	9	4 44 40.8	58.54	10 53.00	0.623
Mon.	10	4 21 13.8	+58.69	10 37.87	0.638
Tues.	11	3 57 43.6	58.82	10 22.38	0.652
Wed.	12	3 34 10.6	58.93	10 06.55	0.666
Thur.	13	3 10 35.1	+59.02	9 50.41	0.679
Fri.	14	2 46 57.6	59.10	9 33.97	0.691
Sat.	15	2 23 18.4	59.16	9 17.24	0.702
Sun.	16	1 59 37.9	+59.21	9 00.25	0.713
Mon.	17	1 35 56.5	59.24	8 43.00	0.723
Tues.	18	1 12 14.5	59.26	8 25.54	0.732
Wed.	19	0 48 32.2	+59.26	8 07.86	0.740
Thur.	20	0 24 50.2	59.24	7 50.01	0.747
Fri.	21	S. 0 01 8.6	59.22	7 31.99	0.754
Sat.	22	N. 0 22 32.2	+59.18	7 13.84	0.759
Sun.	23	0 46 11.6	59.12	6 55.58	0.763
Mon.	24	1 09 49.7	59.05	6 37.24	0.766
Tues.	25	1 33 26.0	+58.97	6 18.83	0.768
Wed.	26	1 57 00.0	58.87	6 00.38	0.769
Thur.	27	2 20 31.6	58.76	5 41.92	0.769
Fri.	28	2 44 00.3	+58.63	5 23.46	0.768
Sat.	29	3 07 25.7	58.49	5 05.03	0.766
Sun.	30	3 30 47.6	58.33	4 46.65	0.764
Mon.	31	3 54 05.6	58.16	4 28.35	0.761

	CHRONOMETER of G. M. T.				Rate	
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SUN'S RIGHT ASCENSION, 1902

	JANUARY			FEBRUARY			MARCH		
	h.	m.	s.	h.	m.	s.	h.	m.	s.
1	18	44	13.57	20	56	43.44	22	46	04.94
2	18	48	38 54	21	09	48.10	22	49	49.75
3	18	53	03.21	21	04	51.96	22	53	34.07
4	18	57	27.52	21	08	55.01	22	57	17.93
5	19	01	51.46	21	12	57.26	23	01	01.33
6	19	06	14-98	21	16	58.70	23	04	44.31
7	19	10	38.07	21	20	59.34	23	08	26.87
8	19	15	00.68	21	24	59.19	23	12	09.03
9	19	19	22.80	21	28	58.23	23	15	50.81
10	19	23	44.38	21	32	56.48	23	19	32.23
11	19	28	05.40	21	36	53.94	23	23	13.29
12	19	32	25.84	21	40	50.61	23	26	54.02
13	19	36	45.66	21	44	46.50	23	30	34.43
14	19	41	04.84	21	48	41.62	23	34	14.54
15	19	45	23.36	21	52	35.97	23	37	54.36
16	19	49	41.20	21	56	29.57	23	41	33.92
17	19	53	58.33	22	00	22.42	23	45	13.22
18	19	58	14.74	22	04	14.55	23	48	52.31
19	20	02	30.41	22	08	05.96	23	52	31.18
20	20	06	45.33	22	11	57.67	23	56	09.88
21	20	10	59.49	22	15	46.71	23	59	48.41
22	20	15	12.88	22	19	36.09	0	03	26.81
23	20	19	25.49	22	23	24.83	0	07	05.10
24	20	23	37.32	22	27	12.95	0	10	43.30
25	20	27	48.36	22	31	00.47	0	14	21.44
26	20	31	58.62	22	34	47.41	0	17	59.54
27	20	36	08.09	22	38	33.79	0	21	37.63
28	20	40	16.76	22	42	19.63	0	25	15.72
29	20	44	24.63				0	28	53.84
30	20	48	31.70				0	32	32.00
31	20	52	37.97				0	36	10.25

TABLE OF CORRECTION

TO BE APPLIED TO THE

True Altitude of the Polar Star

FOR THIS YEAR

Right Ascension OF MERIDIAN.		Apparent Altitude of POLAR STAR. *Correction* **Subtractive.**			*Right Ascension* OF MERIDIAN.		Apparent Altitude of POLAR STAR *Correction* **Additive.**		
H. M.	H. M.	20°	40°	60°	H. M.	H. M.	20°	40°	60°
		° ′	° ′	° ′			° ′	° ′	° ′
1 30	1 0	1 20	1 20	1 20	13 0	13 30	1 20	1 20	1 20
2 0	0 30	1 18	1 18	1 18	12 30	14 0	1 18	1 18	1 18
2 20	0 10	1 17	1 17	1 17	12 10	14 20	1 17	1 17	1 17
2 40	23 50	1 15	1 15	1 15	11 50	14 40	1 15	1 15	1 15
3 0	23 30	1 12	1 12	1 11	11 30	15 0	1 12	1 12	1 13
3 10	23 20	1 10	1 10	1 9	11 20	15 10	1 10	1 10	1 11
3 20	23 10	1 8	1 8	1 7	11 10	15 20	1 8	1 8	1 9
3 30	23 0	1 6	1 6	1 5	11 0	15 30	1 6	1 6	1 7
3 40	22 50	1 5	1 5	1 4	10 50	15 40	1 5	1 5	1 6
3 50	22 40	1 2	1 2	1 1	10 40	15 50	1 2	1 2	1 3
4 0	22 30	1 0	0 59	0 58	10 30	16 0	1 0	1 1	1 2
4 10	22 20	0 58	0 57	0 56	10 20	16 10	0 58	0 59	1 0
4 20	22 10	0 55	0 54	0 53	10 10	16 20	0 55	0 56	0 57
4 30	22 0	0 53	0 52	0 51	10 0	16 30	0 53	0 54	0 55
4 40	21 50	0 50	0 49	0 48	9 50	16 40	0 50	0 51	0 52
4 50	21 40	0 47	0 46	0 45	9 40	16 50	0 47	0 48	0 49
5 0	21 30	0 45	0 44	0 43	9 30	17 0	0 45	0 46	0 47
5 10	21 20	0 41	0 40	0 39	9 20	17 10	0 41	0 42	0 43
5 20	21 10	0 39	0 38	0 37	9 10	17 20	0 39	0 40	0 41
5 30	21 0	0 35	0 34	0 33	9 0	17 30	0 35	0 36	0 37
5 40	20 50	0 32	0 31	0 30	8 50	17 40	0 32	0 33	0 34
5 50	20 40	0 29	0 28	0 27	8 40	17 50	0 29	0 30	0 31
6 0	20 30	0 26	0 25	0 24	8 30	18 0	0 26	0 27	0 28
6 10	20 20	0 22	0 21	0 20	8 20	18 10	0 22	0 23	0 24
6 20	20 10	0 19	0 18	0 17	8 10	18 20	0 19	0 20	0 21
6 30	20 0	0 16	0 15	0 14	8 0	18 30	0 16	0 17	0 18
6 40	19 50	0 12	0 11	0 10	7 50	18 40	0 12	0 13	0 14
6 50	19 40	0 9	0 8	0 7	7 40	18 50	0 9	0 10	0 11
7 0	19 30	0 5	0 4	0 3	7 30	19 0	0 5	0 6	0 7
7 10	19 20	0 2	0 1	0 0	7 20	19 10	0 2	0 3	0 4

NOTE.—The correction should be taken from that column which most nearly corresponds with the approximate Latitude.

DELAWARE BAY AND RIVER.

Lighthouses, Lightships, Range Lights, Buoys, Etc., Etc., Marking Main Ship Channel to Philadelphia and Entrance to Bay and River Delaware.

NOTE.—Compass Bearings and Courses are Magnetic and Distance expressed in Nautical miles (2026.66 Yards to the mile).

Corrected and Revised to January 1, 1901.

There are forty-five lights, including and commencing with the two Five Fathom Bank and Overfalls Light Vessels, established as aids to the entrance of and navigation of the Delaware Bay and River.

After having made and passed the Five Fathom Bank, both ends of which are marked by a light vessel having a first-class steam fog-whistle, a vessel can take up the Delaware Breakwater Range, which will carry her clear of McCries and South Shoals and up to Overfalls Light Vessel at the entrance of the Bay, and enable her to shape a course for Brandywine Shoal Light.

Overfalls Light Vessel moored in 72 feet of water, about 3½ miles to the southward and westward of Overfalls or South Shoal, entrance to Delaware Bay, Del. Two fixed white reflector lights, visible 12 miles. Fog signal is a 12-inch steam whistle, giving a blast of 3 seconds' duration, separated by silent intervals of 27 seconds. If the whistle be disabled, a bell will be rung by hand. The vessel has two masts, schooner rigged, no bowsprit, red hoop-iron day-mark at each masthead, and name in large black letters on each side and "No. 46" on each quarter in black. The hull is painted straw color.

Cape May Light House, N. N. E. ¼ E. 8½ miles.

Cape Henlopen Light House, W. S. W. ⅝ W. 3⅛ miles.

Brandywine Shoal Light House N. by W. ⅛ W. 11⅞ miles.

Cape Henlopen Light. — Twenty-three and three-fourth miles from Five Fathom Bank Light-vessel. This light shows red within an angle of about 45 degrees, formed by a line extending from the light to Brandywine Shoal Light (passing outside the Shears and Brown shoals) and a line extending from the light and just clearing the Northwest end of the Delaware Breakwater.

When the light shows white, vessels between Brandywine shoal and Cape Henlopen are clear of all shoals to the Westward, including and below Brown Shoal. When faintly tinged with red, it indicates proximity to the old range line; and when bright red, it is dangerous to pass farther to the Westward until reaching the point above Brown Shoal, where a change of course is made to go up the bay, and Fourteen Foot Bank Light shows white. Vessels seeking harbor above or behind the breakwater, and wishing to enter at the northern end, will be clear of the breakwater as soon as Cape Henlopen light again changes to white.

Delaware Breakwater (East End.)—This light illuminates the entire horizon. It shows fixed red from the bearing W. ¼ S. around by the southward to ESE. ½ E. (from seaward); throughout the rest of the horizon it shows fixed white.

The focal plane is 65 feet above mean low water.

The light should be seen in clear weather from the deck of a vessel 15 feet above the sea 13½ nautical miles. Fog-signal: Daboll trumpet giving blasts of 2 seconds' duration at intervals of 13 seconds.

The structure is an iron tower painted dark brown, surmounted by a lantern painted black.

To vessels coming from the southward, this light shows red, clear of the sand hills to the northward of Cape Henlopen Light. Care should be taken not to approach the latter light too closely, in order to avoid the Hen and Chickens shoal.

Delaware Breakwater front light (fixed white separated by eclipses), in range with this light (fixed red) marks a line clear of the northern end of the Hen and Chickens shoal. When this light is in range with the Delaware Breakwater rear

light, or when it changes from a red to a white light, or bears W. ¼ S., it marks a line passing about one hundred and fifty yards clear of the point of the Cape, and vessels should approach no nearer the Cape than this line.

When in range with Cape Henlopen Light, this light marks the line of shoals making down from the Shears shoal.

A change in this light from white to red (when it bears E. S. E. ½ E.) marks the inside limit of the outer harbor. This light showing red and Cape Henlopen Light showing white guides clear of the western end of the Breakwater and into the Breakwater harbor.

Delaware Breakwater Front Light.—This light, fixed white during periods of 2½ seconds, separated by eclipses of 2½ seconds' duration, thus:

Fixed light	Eclipse	Fixed light	Eclipse
2½ sec.	2½ sec.	2½ sec.	2½ sec.

in range with Cape Henlopen Light marks a line inside the shoals, making down from the Shears shoal.

Cape Henlopen Day Beacon.—A day beacon pyramidal in shape, 20 feet square at base and 10 feet at top, 49 feet high. Two-thirds of a mile from Cape Henlopen Lighthouse, on the line heretofore marked by the Cape Henlopen Beacon and Main Lights, about 1500 feet from the point of the cape. The lattice-work, which is on the side looking up Delaware Bay only, is painted white with a black cross; the rest of the structure is painted white.

Delaware Breakwater (West End) Light.—An iron post 30 feet above mean high water, a fixed red light illuminating the entire horizon on the extreme westerly end of Delaware Breakwater, inside of Cape Henlopen, west side of the entrance to Delaware Bay.

Delaware Breakwater Rear Light.—A fixed white light about 2 miles northwest of Lewes, Delaware. This light with the Delaware Breakwater front (fixed white separated by eclipses), light forms a range for entering Delaware Bay. The range-line runs E. ¼ N. and W. ¼ S., and vessels entering must not pass to the north of range-line until Cape May lighthouse bears NNE. or Brandywine light shows white. This light (Delaware Breakwater Rear), is visible along the Delaware shore from the northward between the bearings SE. ⅛ S. and S. by E. ⅛ E. and from the southward to a line bearing WSW. ⅛ W., between WSW. ⅛ W. and S. by E. ⅛ E. (the angle covering "The Shears" and the National Harbor of Refuge) the light is not visible. Vessels coming down the bay on the eastern edge of the red sector of Cape Henlopen light, and bound for the Breakwater, will be clear of the lower end of The Shears and the southerly end of the breakwater of the National Harbor of Refuge (now under construction), when the rear light of the Breakwater range becomes visible on the bearings WSW. ⅛ W. These bearings are from seaward.

The eastern and western sides of the channel in Delaware Bay are marked as follows:

Brandywine Shoal Light.—On the eastern side of channel. This light shows fixed during periods of 27 seconds, separated by eclipses of 3 seconds' duration, thus:

Fixed light	Eclipse	Fixed light	Eclipse
27 sec.	3 sec.	27 sec.	3 sec.

white from N. by W. ¼ W., through Westward to SSE. ½ E. (from seaward) and red throughout the remaining sector visible 12 miles. Fog signal: Bell struck by machinery, a double blow every 30 seconds. Red, screw-pile structure and screw-pile ice-breaker.

Fourteen Foot Bank Light.—On the western side of channel. This light shows fixed during alternate periods of 14 seconds and 40 seconds, separated by eclipses of 3 seconds' duration, thus:

Fixed light	Eclipse	Fixed light	Eclipse
14 sec.	3 sec.	40 sec.	3 sec.

white between the bearings NNW. through Eastward to SSE. ¼ E. (from seaward) and red throughout the remaining sector, covering Brown Shoal to the southward and Joe Flogger Shoal to the northward. The structure consists of cylindrical foundation expanding in trumpet shape under main gallery and surmounted by a two-story dwelling with gable roof, tower, surmounted by lantern, rises from east side of dwelling. The entire structure painted brown. Fog signal: Daboll trumpet; blasts 5 seconds, intervals 25 seconds.

Cross Ledge Light.—On the eastern side of channel. This light shows fixed during periods of 17 seconds, separated by eclipses of 3 seconds' duration, thus:

Fixed light	Eclipse	Fixed light	Eclipse
17 sec.	3 sec.	17 sec.	3 sec.

white from NNW. through Westward to SE. by S. (from seaward), and red throughout the remaining sector. Fog signal: Bell struck by machinery every 10 seconds. Black lantern on white dwelling with lead-colored trimmings, green shutters and mansard roof, on granite pier.

Ship John Shoal Light.—On the eastern side of channel. This light shows fixed during periods of 10 seconds, separated by eclipses of 5 seconds' duration, thus:

Fixed light	Eclipse	Fixed light	Eclipse
10 sec.	5 sec.	10 sec.	5 sec.

white, from NNW. ¾ W., through Westward to SE. ¾ S. (from seaward) and red throughout the remaining sector. Fog signal: Bell struck by machinery, a treble blow every 45 seconds. Black lantern surmounting brown octagonal dwelling, one story, with high mansard roof on brown cylindrical foundation.

Sailing Directions.—Vessels bound up Delaware Bay are clear of danger on the east side of channel so long as Brandywine Light shows white until within one mile of this light, but should approach no nearer Brandywine Shoal. When clear of Brown Shoal vessels should run for Fourteen Foot Bank Light, keeping it white until about ½ mile to the eastward, and abreast of it; after passing keep the light showing white, but occasionally sheering over to the westward to touch the red ray, so as to assure not being too far to the eastward, then run towards Cross Ledge Light, keeping both Brandywine and Cross Ledge Light white until abreast of Cross Ledge; when Cross Ledge Light is passed and the red sector in Mahon River light (the north edge of which marks the Cross Ledge buoy No. 14½ red and the south edge marks about 750 feet above the Elbow of the Ledge Buoy, an ice buoy during the winter and gas buoy showing a white light during remainder of the year, red No. 14), is run through the white light appearing, vessels can sheer over to the eastward touching the red ray in either Ship John Shoal or Cross Ledge Lights, thence keep Ship John Shoal, a white light, until within three miles of this light, at which point both Ship John Shoal and Cross Ledge Lights should show white, thence pass Ship John Shoal, keeping the Cross Ledge Light white, thence run for the Port Penn ranges, keeping Ship John Shoal white.

In coming down the Bay, keep the Port Penn ranges on the Ship John Shoal white until within three miles of this light, then keep Cross Ledge white until three miles below Ship John Shoal, at which point both Ship John Shoal and Cross Ledge should show white; then keep Ship John Shoal white until abreast of Cross Ledge; then steer for the Fourteen Foot Bank Light, keeping it white, passing it about ½ mile to the eastward, keeping Brandywine Shoal and Cross Ledge Lights, both white until one mile below Brandywine; then run in the white light of Cape Henlopen and Brandywine.

Vessels bound into the outer harbor of Delaware Breakwater are clear of the Shears Shoal, and the southerly end of the breakwater of the National Harbor of Refuge (now under construction), so long as Delaware Breakwater rear light is in view. In daylight Cape Henlopen Day Beacon, about 1,500 feet from the point of the Cape, on with the Cape Henlopen Lighthouse marks the edge of the Shears Shoals, and in passing up the bay vessels should pass to the eastward of this line until above the shoal. Vessels bound to

the northward and eastward through the channel between the shoals off Cape May and McCries shoal, now generally used by coasting vessels, know when bound down the bay, when Delaware Breakwater rear light comes in range with Delaware Breakwater front light, that they are clear of South Shoal, and can change their course through the channel. Vessels bound into Delaware Bay, by keeping these lights in range are clear of shoals off Cape May, and when Brandywine light shows white they can change their course up the Bay.

The rule for the navigator to remember is that a change of a light which is indicated to mark part of a channel, from white to red, warns him that he is getting too near the shoals on the eastern or western side of the channel.

The channel lights of Delaware Bay, with the exception of Fourteen Foot Bank, are all on the eastern side of the channel. The Fourteen Foot Bank Light must be passed to the eastward.

The system of ranges beginning with the Port Penn Range taken up after passing Ship John Shoal Light, is continuous and almost unbroken, and leading through good water to a point opposite the Philadelphia wharves. Including the range marking the entrance to the Schuylkill River, the system consists of 12 separate ranges formed by 25 distinct lights, in a distance of about 50 miles. The improvement of the channels of the Delaware River has always been made in conjunction with the establishment of the ranges, and this improvement is constantly going on. The artificial channels are being gradually deepened and widened, and consequently the facilities for heavy draught vessels are continually increasing. Light draught vessels should always give way to vessels of deep draught when the latter are upon any of the ranges. It is unlawful for any vessel to anchor upon the line of any range, or so that she swing upon the range, and the master of the lighthouse tender has special orders to report any infraction of the law in this respect.

Vessels approaching from the southward should exercise care in keeping clear of the Hen and Chickens Shoal. When the Delaware Breakwater Light (east end) is on with the breakwater front light, vessels will be to the north and clear of this shoal. In approaching from the southward, when abreast of the southern end of this shoal, and when about three miles out from the beach, and in 11 fathoms of water, a safe course to steer will be N. by W. until to the northward of the shoal, when Delaware Breakwater Range can be brought on to guide safely in the Bay. In thick weather, a vessel knowing her approximate position should not get less than ten fathoms of water until clear of the Hen and Chickens Shoal. The navigator will have the fog signal (Daboll trumpet) on east end of Delaware Breakwater and the bell buoy on the point of Henlopen Shoal on one hand, and the Overfalls Light Vessel with steam fog signal about 3½ miles to the southward and westward of Overfalls or south shoal on the other, to aid him in finding his way in.

Five Fathom Bank.—This bank is nine and one-quarter miles in length, ranging in breadth from three-quarters to two miles, with a depth of from five fathoms to 14 feet. The bank at each end is marked by a light vessel with a first-class steam fog signal. The vessels bear from each other NNE. ¾ E. and SSW. ¾ W. and are about 11¼ miles apart. One vessel is moored in about 14 fathoms of water, off the northeast end of Five Fathom Bank; she is schooner rigged, painted red, with the words "Northeast end" on each side, and "No. 44" on her stern. A fixed red light is exhibited from the foremast head, and a fixed white light at half mast on the main. They should be visible in clear weather for 11 miles. At the foremast head there is a black, hoop-iron cage day mark, surmounted by a black ball. The fog signal, 12-inch steam whistle, blasts 4 seconds with alternate intervals of 5 and 107 seconds. Should whistle be disabled a bell will be rung by hand. The shoalest part of the bank is about one mile long and one-half mile wide, and is marked on the NE. end by a Red and Black Nun Buoy, in 18 feet of water; SSW. three miles from this buoy, and NW. ½ N. four and one-eighth miles from the Five Fathom Bank Lightship is a Red Nun Buoy No. 2, marking a 21-foot shoal, which is about 200 yards long and 25 yards wide, and over which at times the sea breaks heavily. A lightship, schooner rigged, painted straw color, with the name "Five Fathom Bank" in large letters on each side and "No. 40" on the stern, is moored about six and three-eighths miles to the southward and eastward of the shoalest part of the Five Fathom Bank Shoal, in fifteen fathoms water, showing two fixed white reflector lights, visible 11 miles. For day marks

has a Hoop Iron Cage at each masthead. In foggy weather a steam whistle is used, giving blasts of 4 seconds, intervals 56 seconds. Should whistle be disabled a bell will be rung by hand. The course from Five Fathom Bank Lightship to the entrance to the Delaware Bay is W. $\frac{3}{4}$ N. 20 miles (making allowance for the tide, which on the flood sets about NW. and the ebb S. and on the latter part SE. from one to two knots as the cape is neared). This course will carry into 13 fathoms, mud bottom.

McCries Shoals.—Sand and shells. One mile long and five-eighths wide. Extends ENE. and WSW. Least water, 17 feet. Marked by a Red Buoy, nun-shaped body surmounted by a whistle No. $2\frac{1}{2}$, in 30 feet water near the SE. end. During winter an iron spar buoy is placed near the whistling buoy to mark the station, in case the whistling buoy is carried away or damaged by ice. Is seven miles SE. from Cape May Lighthouse. One and three-quarter miles W. $\frac{1}{4}$ N. from McCries Shoals is a three-fathom lump, not buoyed. S. by W. from Cape May Lighthouse, distant six miles, is a can buoy, red and black stripes, in three fathoms water, marking the east end of 15-foot shoal.

A range for entering Delaware Bay is formed by Delaware Breakwater front light and Delaware Breakwater rear, a fixed white light shown from a brown iron tower, about two miles NW. from the town of Lewes, Del. This range runs E. $\frac{1}{4}$ N. and W. $\frac{1}{4}$ S., and carries a vessel in, clear of McCries and South Shoals. A vessel entering the Capes will be guided clear of all danger by the Delaware Breakwater Range, and being on that range when Cape May Light bears NNE. $\frac{3}{4}$ E., or when Brandywine Light shows a white light, she is clear of the shoals and can shape her course N. by W. $\frac{1}{2}$ W. toward Brandywine Shoal Light.

Overfalls or South Shoal.—Seven and seven-eighths miles W. $\frac{1}{2}$ S. from the Buoy on McCries Shoal is an iron ice buoy in eight fathoms of water marking the southern extremity of these shoals and northern edge of the channel in Delaware Bay. Cape May Light bears NNE. $\frac{5}{8}$ E. 7 miles; between this and McCries Shoal buoys and Cape May, the bottom is broken into a number of large and small shoals, on which the least water is 12 feet, until within two and one-half miles from Cape May Lighthouse, where there are numerous spots with but four and five feet of water on them.

The Hens and Chickens.—Extends from the point of Cape Henlopen three miles in a SSE. direction, with a channel for small vessels between it and the beach. Bottom of shoal generally fine gray sand; least water five feet. A black can buoy in four fathoms water. Cape Henlopen Lighthouse bearing NW. by N. marks the south end of the shoal; and nearly up to the nothern end is a spar buoy with white and black stripes in three fathoms water, marking the entrance to inner channel, Cape Henlopen Lighthouse bearing SW. by W $\frac{3}{4}$ W.

Shoal off Point Cape Henlopen.—A dangerous shoal off Cape Henlopen, buoyed as follows: A bell buoy, painted black, moored in $4\frac{1}{2}$ fathoms of water at the elbow of the shoal. Magnetic bearings as follows: Cape Henlopen Lighthouse, S. by W. $\frac{1}{8}$ W.; Delaware Breakwater (east end) Lighthouse, WNW. $\frac{1}{8}$ W. Also an iron ice buoy, painted black, placed in four fathoms water, Cape Henlopen Light bearing S. $\frac{1}{4}$ E. Delaware Breakwater Front Light, W. by N., and Delaware Breakwater Rear Light, W. $\frac{1}{4}$ S. Vessels should pass outside, that is to the northward and eastward of these buoys. Great caution should be observed in approaching this shoal, as the soundings change very suddenly from 8 to 3 fathoms. In coming from the southward when the Delaware Breakwater Light east end changes from red to white, or with this light in range with Delaware Breakwater Rear fixed white light, marks a course clear of all dangers close to the Cape. In running in for the Cape from the southward do not get within 11 fathoms, or say 3 miles of the beach, as the soundings are irregular. Steer up N. by W. $\frac{1}{2}$ W. making allowance for the tides which, this close in, generally set along the coast, except in the latter part of the ebb, when it sets SW., giving a good berth to the black can buoy, marking the south end of the Hen and Chickens Shoal, which is one and one-quarter miles from the beach. The point of the Cape should be given a good berth. The course N. by W. $\frac{1}{2}$ W. with tide allowance, will carry up to Brandywine. If intended to anchor inside Cape Henlopen after passing the point of the Cape, haul in WNW., going to the northward of spar buoy, with red and black stripes, in 3 fathoms water on Marshall's Shoal, and about $\frac{1}{2}$ mile from the

Breakwater. You may now choose a berth behind the breakwater or stand on, haul around it, and anchor within half a mile of it. Three and a half to five fathoms water, muddy bottom.

National Quarantine Anchorage.

The anchorage limit is unmarked by buoys.

NOTE.—The Breakwater of the National Harbor of Refuge near the Delaware entrance is now under construction.

Main Ship Channel.—After passing Overfalls Light Vessel the course is N. by W. ½ W., passing midway between the point of Cape Henlopen and the iron ice buoy at South Shoal. On entering the bay on this course, channel soundings are 12 to 16 fathoms, coarse sand, mud and shells. When bound up the bay do not get to the westward of the range of the Day Beacon on with Cape Henlopen Lighthouse if daylight; if at night keep Cape Henlopen Light showing white (when it changes to red indicates that you are running too far to the westward) so as to avoid the Shears, a shoal on which the least water on the eastern side is 10 feet.

The Shears.—A shoal on the west side of entrance to Delaware Bay is to be guarded against, especially during the half and third quarter of flood tide, which sets on and across them from one to one and three-quarters knots. The main shoal is one mile wide at its lower end, from near the end of which are shoals extending in a southeast direction, with 3½ to 4½ fathoms of water between them. The southeast extension or horn is three-quarters of a mile long, least water 10 feet. The other horn or leg from the southwest corner extends about one mile, depth of water at extreme end, 18 feet. A red and black striped buoy marks the 14-foot spot on this point. If bound up the Bay, on leaving the anchorage give a good berth to the southeast horn of the Shears, keeping to the eastward of it, and steer up about N. ¼ W. (allowing for tide) for Brandywine Shoals Light. (This light shows fixed during periods of 27 seconds, separated by eclipses of 3 seconds' duration), white from N. by W. ¾ W., through W. to SSE. ½ E. (from seaward) and red throughout the remaining sector, visible 12 miles, leaving bell buoy (replaced during winter by an iron ice buoy) on Brown Shoal to port.

Brown Shoal.—An automatic bell buoy, (replaced during winter by an iron ice buoy) in four fathoms water marks the southern end of Brown shoal, on which the least water is 8 feet, and 3 miles further up is the Brandywine Shoal Lighthouse.

Brandywine Shoal.—Extends 3½ miles in a NNW. and SSE. direction. South end marked by a red nun buoy (replaced during winter by an iron ice buoy) in 4 fathoms of water, ¼ of a mile from the Lighthouse. For the distance of 1¼ miles above the Lighthouse there are dry spots at extreme low water. The elbow or midway of shoal is marked by a red spar buoy (replaced during the winter by an iron ice buoy). The northern end of shoal is marked by a red nun buoy (replaced during winter by an iron ice buoy) in 21 feet water. When nearing the Brown, water shoals gradually to 6 and then deepens

to 7 and 8 fathoms, until past Brandywine. When Cross Ledge Light shows white you are clear of Brandywine Shoal. From Brandywine to Buoy of the Middle, your course on the flood tide is NNW. ½ W.; on ebb tide NNW. distance 15½ miles. When in 7 fathoms of water the lighthouse bearing E., steer the course according to the tide as given, carrying 5 and 6 fathoms of water until abreast Fourteen Foot Bank Lighthouse, on the west side of the channel, marking the location of what is called Fourteen Foot Bank. When abreast of Fourteen Foot Bank Light keep Brandywine Light showing white which will guide you clear of Cross Ledge Shoals. In keeping the channel the Fourteen Foot Bank Lighthouse is left to the westward. (This light shows fixed during alternate periods of 14 and 40 seconds, separated by eclipses of 3 seconds' duration, while between the bearings NNW. through E. to SSE. ⅛ E. (from seaward), and red throughout the remaining sector, covering the Brown Shoal to the southward, and Joe Flogger Shoal to the northward. Fog signal, (Daboll trumpet, blasts 5 seconds, intervals 25 seconds.) N. by W. ½ W. 1½ miles from the lighthouse is a spar buoy in 3 fathoms of water marking the lower end of Joe Flogger Shoal. As this shoal is of hard sand, nearly dry in places at low water, and rises quickly from 3½ and 4 fathoms along most of its length of 15 miles, it should be approached cautiously.

In 4½ fathoms water is a first-class nun buoy (replaced during winter by an iron ice buoy) painted red, marking western edge of Miah Maull Shoal, and starboard side of channel. Two and three-fourths miles NW. from Miah Maull Shoal Buoy is a black spar buoy, No 11A in 24 feet of water, marking the swash channel across Joe Flogger to the westward into Blake's channel, 1¾ miles N. by E. ⅛ E. of No. 11A buoy, is the lighthouse on Cross Ledge Shoal. (This is a frame building on a granite pier, near the lower end of the shoal. Fixed white light during periods of 17 seconds, separated by eclipses of 3 seconds' duration, from NNW. through W. to SE. by S. (from seaward), and red through the remaining sector visible 13 miles. In foggy weather a bell is sounded at intervals of 10 seconds. Channel soundings 5 to 7 fathoms, soft bottom, and to the westward until approaching Cross Ledge Buoy. No. 14½, when the eastern side has soft bottom, and west side getting harder. When abreast of Cross Ledge, keep Ship John Shoal Light showing as a white light, which will guide you clear of Cross Ledge Shoal. Two and one-quarter miles above the lighthouse is a gas buoy, showing a white light, buoy painted red (replaced during the winter by an iron ice buoy), in 4½ fathoms of water, marking the elbow of Cross Ledge Shoal on the east side of the channel. One and five-eighths miles N. by W. from this buoy is a first-class nun buoy, red, (replaced during winter by an iron ice buoy), moored in 24 feet water, on the eastern side of the channel. Mahon River Light at mouth of Mahon River, west side of Delaware Bay, Delaware. Fixed white light, with two red sectors, the lower one between the bearings W. 5-16 N. and W. ⅞ S., about 14 degrees (one and one-quarter points of the compass). The S. edge of the sector marks about 750 feet above the Elbow of Ledge Buoy (red, No. 14), and the N. edge marks the Cross Ledge Buoy No. 14½. The upper one between the bearings SSW. ⅜ W. and SSW. ¾ W., and marks the locality of Joe Flogger Shoal (upper end) Buoy, No. 13, black spar, and the northerly entrance to Blake Channel. The white light is visible 13 miles. From abreast Cross Ledge Buoy. No. 14½, the course past Bombay Hook, and ranging the Port Penn Lights to Baker Shoal Buoy, is NW. ½ N. on the flood, and NW. by N. on the ebb. Distance to Bombay Hook, 9¼ miles, and 11½ miles farther to Baker Buoy. About 3 miles above Cross Ledge Buoy, No. 14½, in 17 feet of water is a red nun buoy (replaced during winter by an iron ice buoy), on eastern side of the channel and marking the western edge of the shoal, making out from Ben Davis Point. About 5⅝ miles above Cross Ledge Buoy, No. 14½, is a black spar buoy in 24 feet water marking the northern end of Joe Flogger Shoal and the western side of channel. The western edge of the ship channel along Joe Flogger Shoal, between Joe Flogger Buoy, No. 9 (lower end), and Joe Flogger Buoy, No. 13 (upper end), is marked by three black buoys, Nos. 11, 11A, and 11B. N. ⅞ W. distant 2½ miles from black spar buoy (upper end of Joe Flogger), is the Ship John Shoal Lighthouse, an iron building in 8 feet of water on the east side of channel. (Shows fixed light during periods of 10 seconds, separated by eclipses of 5 seconds' duration, white from NNW. ¾ W. through W. to SE. ¾ S.

from seaward, and red throughout the remaining sector, visible about 13 miles. Building painted brown. In foggy weather a bell will be struck 3 blows in quick succession at intervals of 45 seconds.) Between the Ship John Shoal Lighthouse and Joe Flogger Shoal, the flood tide tends towards Cohansey Lighthouse, and the ebb sets across the Joe Flogger in the direction of Deep Water Point, WNW. About 1¼ miles from the Ship John Shoal Lighthouse is a black spar buoy in 5 fathoms, hard bottom, marking the eastern edge of Bombay Hook bar, which is steep to, and in places has but 5 feet water on it. When Cross Ledge Light shows white it guides clear of Ship John Shoal. Ship John Shoal Light showing white, guides clear of shoals on eastern side of channel above it. When it changes to red, it indicates that you are running too near these shoals.

Cohansey Lighthouse.—A white frame dwelling standing on iron piles ; top of lantern red. Situated on the New Jersey shore, bearing ENE. ¼ E. from Bombay Hook Buoy, and NNE. 2 miles from Ship John Shoal Lighthouse. The channel here, between the Joe Flogger and Ship John Shoals, is about 1 mile wide, and care must be taken on leaving it, as on either side the water shoals quickly from 5 and 3½ fathoms to 9 and 8 feet until past Arnold's Point. Four and five-eighth miles from Bombay Hook Buoy is Bombay Hook Lighthouse, a white brick building, lantern red, showing fixed white light, 1½ miles from the western side of the channel. Opposite this lighthouse and on the eastern side of the channel is a red spar buoy in 18 feet water, marking the western edge of shoal off Arnold's Point. Just above Arnold's Point Buoy, the cut through Duck Creek Flats will be reached. This cut is marked with three spar buoys, two at the lower entrance, 18A on the starboard side and 15A on the port side, 15B marks the northerly end of cut port side. After passing Bombay Hook Lighthouse and up to Liston's Point, a distance of 3 miles, the soundings are 3¼ to 3½ fathoms, and is the least water to be found in the Delaware channel between Cape Henlopen and Fort Delaware. From Liston's Point steer up for the range light at Port Penn, the front light fixed white during periods of 2 seconds separated by eclipses of 1 second's duration. The rear light is fixed white, keeping the rear or higher light open to the eastward of the lower light about ¼ point until near up to Ridge buoy, black No. 17, on the western side of channel, where the Reedy Island Range will be taken up and followed until up to Baker Shoal, which is marked by a spar buoy painted red, in 21 feet water, placed on the western point of the shoal above Stony Point, and is nearly abreast the turning point on the east side of channel. When near this buoy the lights on Finns Point, the front light fixed white during periods of 2 seconds separated by eclipses of 1 second's duration, the rear light fixed white, will come in range. Steer up for them about N. by E. water deepening when past Reedy Island to 5, 7 and 9 fathoms, soft and sticky bottom.

Reedy Island (Front) Range.—Fixed light, during periods of 7 seconds, separated by eclipses of 1 second duration :

	Fixed light	Eclipse	Fixed light	Eclipse
Thus :	7 sec.	1 sec.	7 sec.	1 sec.

Thirty-six feet above sea level, on white dwelling, with lead-colored trimmings and green shutters. On the lower end of Reedy Island visible 11 miles. The light shows white from N. by E. ⅞ E. to N. ⅛ E.; in this sector the part covering Reedy Island and that portion of the river lying to the westward of the island the light is somewhat obscured. Between N. by E. ⅞ E. and N. ⅛ E., the part covering the dike, the light shows red (from seaward). Fog signal is a bell struck by machinery at intervals of 15 seconds.

Thus:	1 blow,	Silent interval,	1 blow,	Silent interval,
		15 sec.		15 sec.

The dike extending to the southward from the south end of Reedy Island, Delaware River, is covered by a narrow sector in this light in which the light shows red. The sector lies between N. by E. ¼ E. and N. ⅛ E. (from seaward). Vessels bound into Reedy Island Harbor from the southward will keep the Port

Penn Ranges on, passing through the red cut in this light until reaching a white light, when they will be clear of the end of the dike, and are free to stand up the harbor.

Reedy Island (Rear) Range.—Fixed white light in the village of Port Penn, nearly 1 1-16 miles N. by W. in rear of Reedy Island front. Black, triangular, pyramidal, skeleton, iron tower; the upper 40 feet of its channel face covered with a day mark of horizontal slats. A white one-story frame dwelling, with lead-colored trimmings, green shutters and brown roof, just to the southward of the tower. This light and Reedy Island front in range intersects with the Port Penn Range line near Ridge Buoy, No. 17, black, and with the Finns Point Range line nearly abreast Baker Shoal Buoy, No. 20. The range should be used between the points of intersection, and vessels should not pass to the westward of it. When nearly up to the red and black spar buoy, in 18 feet water, near the lower end of Pea Patch Shoals, the lights below Newcastle, the front light fixed white during periods of 2 seconds, separated by eclipses of 1 second's duration, the rear light fixed white, will come in range, bearing nearly NNW. Steer for them, keeping the detached tower (front) on with the rear or high light when the range line is followed. Go between the red spar buoy off Finns Point, on the east side of the channel, and the black spar buoy on the lower end of Bulkhead Shoals, soundings 5½ to 6 fathoms, hard bottom. Deep draught vessels will take care to pass from the Newcastle to Deep Water Point Ranges, to eastward of their intersections, and about halfway between the red nun buoy (replaced during winter by an iron ice buoy), Goose Island Flats and the black spar, marking the bight of the bulkhead. A red cut in the Finns Point rear light marks the Bulkhead Shoals, and will assist vessels in judging of the proper point at which to commence the turn at this locality. Vessels running on the ranges established here, when nearing the buoys next above or below the turning buoy, will see a faint reddish light shown from Finns Point rear tower; when abreast of either of these buoys the light will appear a bright red. The red light indicates the points at which the turn should commence.

Having passed the gas buoy showing a white light, buoy painted red (replaced during the winter by an iron ice buoy) in 18 feet water, on the western edge of Goose Island Flats (channel soundings 4½ fathoms, soft bottom), and half-way between it and the black spar buoy (in 17 feet water), marking the bight of Bulkhead Shoal on the western side of channel, the lights of Deep Water Point, the front light fixed white during periods of 2 seconds, separated by eclipses of 1 second's duration, the rear light fixed white, will then be in range. Vessels of deep draught are cautioned not to go to the eastward of Deep Water Point Range when opposite the upper Bulkhead Buoy. Steer for the range lights on Deep Water Point until you bring the Cherry Island Flats range lights in line, leaving the red and black striped spar buoy, in 18 feet water, on the upper end of Bulkhead Shoal, on the port hand passing the lighthouse (fixed white on a dwelling house), at the mouth of Christiana Creek, and fixed white light on a post near end of pier. On Cherry Island Flats there are places with but 3 feet of water.

Cherry Island Flat Range Lights on the Delaware shore, mark the cut through Cherry Island Flats, and intersect the Deep Water Point Range in deep water. Front light fixed white, during periods of 2 seconds, separated by eclipses of 1 second's duration, on tower painted white, with black lantern on pier near low-water line. Rear light fixed white on a tower, attached to a dwelling painted white with black lantern. The beacons in range mark the middle of the cut, and vessels can stand on, until abreast of the first class red spar buoy marking the east side of the upper end of the cut, showing where vessels should leave the Cherry Island Range and take the natural channel of the river until nearly abreast of Seventeen Foot Knoll Buoy, where the light in Cherry Island front light station will show red, and intersect with the Schooner Ledge Range Lights at a point to the westward of Seventeen Foot Knoll Buoy, indicating where to leave and take up the Schooner Ledge Range lights.

Grubbs Landing Light.—A fixed red light on end of a wharf below Grubbs Landing, Delaware, westerly side of the Delaware River, and below Seventeen Foot Knoll Buoy marks, approximately, the point at which vessels should take or leave the lower end of the Schooner Ledge Range line.

Seventeen Foot Knoll.—A spar buoy painted red marks the lower end of Marcus Hook Shoal and the junction of the channel leading to Raccoon Creek, with the main channel on the New Jersey side of the river.

Half way between Marcus Hook and Chester is a ledge of rocks (Schooner Ledge) having 17 feet of water on them. Three spar buoys, two red and one black mark their location and extent. There is a good channel to the westward of the rocks.

Schooner Ledge Range Lights mark the channel through Schooner Ledge. The front light fixed white during periods of 2 seconds, separated by eclipses of 1 second's duration, is shown from a lantern on the top of a house built on screw piles, and the rear one from an iron tower.

The Schooner Ledge Range intersects, in deep water, the continuation of line joining the front light Cherry Island Range and Christiana Light, and is available from just below Seventeen Foot Knoll Buoy, No. 34, to its intersection with Tinicum Island Range. Vessels must be careful not to pass beyond these intersections.

Near 1 mile above Chester, on the west side of channel is a red and black striped spar buoy, in 20 feet water, marking the lower end of Tinicum Island Spit. Keep midway between it and the red spar buoy (in 18 feet water), or east side of channel and on upper end of Chester Bar Flats.

Tinicum Island and Fort Mifflin Bar Ranges.—The Tinicum Island and Fort Mifflin Bar Range Lights are on the New Jersey Shore, near Billingsport. They consist of a group of three lights, one of them Billingsport front, answering the purpose of a front beacon to each range. The Tinicum Island Range intersects the Schooner Ledge Range, and a vessel can pass directly from the latter to the former. The front light is shown from a detached open framework tower about 50 feet from the dwelling, painted white, and the rear one from an iron tower painted brown. The rear range light of the Fort Mifflin Bar cut is shown from a detached pyramidal wooden tower in front of dwelling. A vessel passing up the river with the Schooner Ledge Ranges on ahead will change her course when she brings the Tinicum Island Range Lights in line; she will stand for them, keeping on that course until the rear Fort Mifflin Bar Light comes in sight, when she will put her helm to starboard and swing around and bring the Fort Mifflin Bar Cut Lights in range, astern. A vessel bound down the river, with the Fort Mifflin Bar Ranges ahead, will, when the rear Tinicum Island Light comes in view, put her helm to port, and swing around so as to bring the Tinicum Island Ranges on astern. The front light of this group of rangee is fixed white during periods of 2 seconds, separated by eclipses of 1 second's duration, and both the rear lights fixed red.

Fort Mifflin Fog Signal Station open frame bell-tower on the parapet just back of the dock at Fort Mifflin, west side of the Delaware River. Fog signal is a bell struck by machinery at intervals of 15 seconds.

Horseshoe Shoal Range Light.—The lights are in two groups, each group consists of 3 lights—a rear light, fixed white, shown from a detached tower, and 2 front lights, one fixed white and the other fixed red, shown from small frame structure, 10 feet high, corresponding in color to the colors of the lights.

The first or lower of these groups is on Fort Mifflin Reservation, about ½ mile above the fort.

The second or upper group is in Howell Cove, about 2 miles below Gloucester, New Jersey.

The Fort Mifflin Bar Cut Range can be held in going up the river to its intersection with the West Group Horseshoe Range, which being brought over the stern, can be held until the red or lower front light of the east group of the Horseshoe Ranges is on with the white rear light of that group. A change of course of 3 points to port will here be made, bringing the East Group Range of 2 white lights on over the stern. The latter is the last range of the Delaware River Ranges going up and carries to Philadelphia.

In coming down the river the East Group Range of 2 white lights will be kept on ahead until the upper or red front light of the west group is on with the white rear light of the group, when a change of 3 points to starboard will be made, bringing the 2 white lights of the west group in range ahead, and this range can be held until its intersection with Fort Mifflin Bar Cut Range.

Channel to the Eastward of Cherry Island Flats, Above Wilmington Creek.

The soundings in the channel to the eastward of Cherry Island Flats are from 3½ to 3¾ fathoms. After passing the 2 red spar buoys on the eastern side of the channel and the black spar buoy (in 16 feet water) on east side of shoal about midway its length, follow the New Jersey shore line with small increase of depth of water until past the red and black spar buoy (in 18 feet water) on the upper end of the flats. After passing this buoy the best water is off the western shore, leaving the buoys to the eastward, and carrying four and five fathoms, soft bottom, up past Marcus Hook.

SAILING DIRECTIONS FOR ENTERING THE BAY BY CAPE MAY CHANNELS.—Run along the land in about 5 fathoms of water, or 1½ miles from the shore, passing outside of Eph's shoal. When Cape May Lighthouse bears NNW. bring the Cape May Spit buoy No. 2 ahead, and steer for it, leaving it close on starboard hand in passing. Steer NW. ¼ N. till up with red buoy No. 6, leaving it and buoy 4 on starboard hand; then steer NW. leaving North Shoal buoy, black, No. 1, and Mummy Shoal buoy, red and black horizontal stripes, on the port hand, and Crow Shoal buoy, red, No. 8, on starboard hand, passing close to on either side of upper entrance channel buoy, leaving No. 10 buoy, opposite Brandywine Shoal, on starboard hand. The best water over bar at entrance to this channel is 15 feet.

If wishing to enter Main Ship Channel after passing upper entrance buoy, steer WNW. ½ W., leaving Brandywine Shoal buoy, lower, No. 6, red on starboard hand.

To pass through the "Through" channel to the Breakwater, bring Bay Shore Life Saving Station to bear NE. ¾ N.; then steer SW. ¾ S., passing North Shoal buoy on port hand, and Mummy Shoal buoy on starboard hand, until the Through buoy bears SSW., then steer for it, passing close to on either side; thence SW. by W. for Delaware Breakwater rear lighthouse until out in main channel.

If bound up Bay Shore channel, after passing North Shoal buoy, No. 1, steer N. ½ E., leaving Crow Shoal buoy on port hand.

NOTE.—For further directions relative to entering the Capes of the Delaware, and of Buoyage of Delaware Bay and River, see Buoy List for 1900, a copy of which, or of the latest Lighthouse List, any shipmaster can obtain, free of charge, upon application to the Branch Hydrographic Office, Bourse Building, Fourth Street above Chestnut, or at the office of the Lighthouse Inspector, Rooms 30 and 31 (fourth floor), Post Office Building, Ninth and Chestnut streets.

Useful Hints on Chronometers—Their Preservation

Chronometers should be handled as little as possible on ship-board, and they should always be kept in the outside cases, screwed down amidships, in some secure place, and free from any current of air.

The outside case should always be kept closed, except when taking time and winding. The reason is obvious—a sudden change of temperature and exposure to sea air is injurious; and a sudden change of temperature will cause a chronometer to sweat, and it will become rusty. As an instance—if you expose a chronometer by leaving the lids of the case up through the night the chronometer may receive a temperature of 40 degrees. In the morning the sun may shine and the day prove very warm, say a temperature of 60 degrees. This sudden change of temperature will cause it to sweat, and it is liable to become more or less rusty, and it then cannot maintain a permanent rate. Hence will be seen the necessity of protecting in a proper manner (with the outside case and every care) this valuable instrument, rendered so necessary in navigation. The outside cases are lined and packed for the express purpose of keeping the chronometer free from exposure to the sea air, and sudden changes of the atmosphere, and they should never be removed.

It has been a subject of extreme vexation to most chronometer makers, the course pursued of late by many ship-masters, in dispensing with the outside case. Many chronometers of the best makes have failed, through rust produced by exposing them.

Be careful when carrying the chronometer to and from the ship to secure the gimbol by the stay to keep it steady, and by all means to avoid quick circular motion.

When on board free the stay; be particular to fasten it back to free the gimbol. Ship time for deck observations is recommended to be obtained by a watch previously compared with the chronometer. In winding, turn it over gently, put the valve back, and apply the winder, turn easy till wound up, avoiding sudden jerks. Ship masters, by attending to the above suggestions, will generally receive a greater amount of satisfaction in the use of the chronometer.

Explanation of Compass Terms.

Variation of the compass is the angle between the true North and the magnetic North. This difference or error arises from the magnetic poles not coinciding with the terrestrial ones, and is due entirely to the influence of the earth on magnetic needles, which is the same at few parts of world.

Deviation of the compass is the angle included between the magnetic North and the compass North. This error is due to the disturbing influences of the iron of which the ship is built, as rudder post, mast, chains, funnel, etc.; her position when building, her cargo, or other causes within the ship.

Local Attraction is the error caused by some disturbing force outside the ship, and belonging entirely to the locality at which the ship may be—as mooring posts or chains, dock cranes, another iron vessel alongside, volcanic or magnetic influences, etc.

*NOTE—**Local Attraction*** and ***Deviation*** are too often confused, the two expressions being used indifferently to mean the same thing, when they are entirely distinct.

Heeling error is the effect produced on the compass by the heeling of an iron or composite ship, the angle increasing with the amount of heel.

Leeway is the angle between the ship's course by compass and the direction which she makes through the water, as shown by her wake.

Compass course is the course steered by ship's compass.

Magnetic course is a compass course corrected for deviation and leeway.

The true course of a ship is the compass course, corrected for deviation, leeway and variation.

PILOTAGE RATES ON THE DELAWARE BAY AND RIVER

Under the Laws of the States of Pennsylvania and Delaware

(Amended 1899)

FEET.	INWARD. If spoken east of Five Fathom Bank Lightship, or north of Hereford Inlet Lighthouse, or south of Fenwick's Island Light.	INWARD. If spoken inside of Five Fathom Lightship and outside of line drawn from Cape May Light to Cape Henlopen Light.	INWARD. If not spoken until inside of line drawn from Cape May Light to Cape Henlopen Light.	OUTWARD.
8	35.20	32.00	28.80	32.00
8½	37.40	34.00	30.60	34.00
9	39.60	36.00	32.40	36.00
9½	41.80	38.00	34.20	38.00
10	44.00	40.00	36.00	40.00
10½	46.20	42.00	37.80	42.00
11	48.40	44.00	39.60	44.00
11½	50.60	46.00	41.40	46.00
12	52.80	48.00	43.20	48.00
12½	68.75	62.50	56.25	62.50
13	71.50	65.00	58.50	65.00
13½	74.25	67.50	60.75	67.50
14	77.00	70.00	63.00	70.00
14½	79.75	72.50	65.25	72.50
15	82.50	75.00	67.50	75.00
15½	85.25	77.50	69.75	77.50
16	88.00	80.00	72.00	80.00
16½	90.75	82.50	74.25	82.50
17	93.50	85.00	76.50	85.00
17½	96.25	87.50	78.75	87.50
18	99.00	90.00	81.00	90.00
18½	101.75	92.50	83.25	92.50
19	104.50	95.00	85.50	95.00
19½	107.25	97.50	87.75	97.50
20	110·00	100.00	90.00	100.00
20½	112.75	102.50	92.25	102 50
21	115.50	105.00	94.50	105.00
21½	118.25	107.50	96.75	107.50
22	121.00	110.00	99.00	110.00
22½	123.75	112.50	101.25	112.50
23	126.50	115.00	103.50	115.00
23½	129.25	117.50	105.75	117.50
24	132.00	120.00	108 00	120.00
24½	134.75	122.50	110.25	122.50
25	137.50	125.00	112.50	125.00
25½	140.25	127.50	114.75	127.50
26	143.00	130.00	117.00	130.00
26½	145.75	132.50	119.25	132.50
27	148.50	135.00	121.50	135.00
27½	151.25	137.50	123.75	137.50
28	154.00	140.00	126.00	140.00
28½	156.75	142.50	128.25	142.50
29	159.50	145.00	130.50	145.00

PILOT REGULATIONS

WARDEN'S OFFICE,
PORT OF PHILADELPHIA.

The attention of ship masters, owners, agents and pilots is called to the following requirements of the various acts of Assembly passed by the Legislature of Pennsylvania:

Every vessel arriving from, or bound to a foreign port, is bound by law to receive a pilot, except outward bound American vessels solely laden with coal mined in the United States.

Every master is bound to report immediately on arriving to the Warden's office, under a penalty of $10, and incurs a like penalty if he does not record his clearance with them before departing.

No license shall be granted to any person to act as a pilot, unless he has served an apprenticeship of six years on board of a pilot boat.

The pilot of every vessel is obliged to inform the master of his having to report at the Warden's office.

Every pilot detained by the master, owner or consignee, or by the ice, is entitled to $3 per day.

Every pilot, obliged by the ice or stress of weather to proceed to another port, is entitled to his pilotage, and if there discharged, to eight cents a mile for every mile he has to travel home.

That masters of vessels shall give an account to the pilot, when boarding, of the draught of such vessel, and in case he shall misrepresent said draught, and give it as less than the actual draught, he shall forfeit and pay the sum of $25, to be sued for and recovered before any alderman of the city of Philadelphia, by the Master Warden, who shall pay the same over, when collected, to the Society for the Relief of Decayed Pilots, their Widows and Orphans; he having first deducted the expenses incurred in recovering the same.

Every ship or vessel is bound to remain at the capes twenty-four hours after its arrival, to give the pilot an opportunity to be taken out, under a penalty of $800.

WILLIAM R. TUCKER,
Master Warden, Port of Philadelphia.

Warden's Office, 350 and 351 Philadelphia Bourse.

PORT WARDEN'S RULES AND REGULATIONS

—FOR—

PORT OF PHILADELPHIA.

HARBOR MASTER'S OFFICE,
SOUTHEAST CORNER WALNUT AND DOCK STREETS.

For the information of owners, masters and others having command, care or charge of vessels within the Port or Harbor of Philadelphia, the following rules and regulations are published:

VESSELS TO REPORT AT WARDEN'S OFFICE.

1. All vessels arriving at the Port of Philadelphia must report at the Warden's Office, Rooms 350 and 351 Philadelphia Bourse, within twenty-four hours after arrival, and before leaving the port must report their clearance. Penalty for neglecting to report, from $10 to $50.

ANCHORAGE.

2. Vessels will be allowed to anchor in the Delaware River as follows:

MARCUS HOOK ANCHORAGE.

Eastward of the channel marked by Schooner Ledge Range Lights, opposite to and above the oil wharves at Marcus Hook.

LEAGUE ISLAND ANCHORAGE.

East of the mouth of the Schuylkill River and north of the channel marked by the lower Horse Shoe White Range Lights.

GREENWICH POINT ANCHORAGE.

East of the lines drawn between three anchorage buoys (being white with a black anchor painted thereon), located opposite (1) the Point House wharf, (2) Salt Works wharf (Porter street), and (3) Dickinson street; this anchorage not to extend south of the Point House wharf (1) buoy, or north of the Dickinson street (3) buoy.

NOTE.—The buoys are located as follows: *Buoy No. 1.*—On the prolongation of the line of the upper (north) side of Point House wharf and distant 1,150 feet easterly on said line from the present N. E. corner of said wharf. *Buoy No. 2.*—On the prolongation of the line of the upper (north) side of the Salt Works wharf (Porter street), and distant 1,100 feet easterly on said line from the present N. E. corner of said wharf. *Buoy No. 3.*—On the prolongation of the line of the upper (north) side of the Dickinson street pier and distant 1,200 feet easterly on said line from the present N. E. corner of said pier.

COOPER POINT ANCHORAGE.

In the channel between Cooper Point and Petty Island, so as not to interfere with vessels going to or from Cooper Creek.

PORT RICHMOND ANCHORAGE.

East of the main ship channel, between the prolongation of lines drawn from the lower and upper ends of Petty Island, as marked by three anchorage buoys (being white with a black anchor painted thereon).

NOTE.—The buoys are located as follows: *Buoy No. 1.*—On a line drawn between the present S. E. corner of Rush street pier and the lower end of the present timber revetment along Petty Island, and distant 1,275 feet southerly on said line from the present S. E. corner of said Rush street pier. *Buoy No. 2.*—On the prolongation of the line of the upper (east) side of William street pier, and distant 1,000 feet southerly on said line from the present N. E. corner of said pier. *Buoy No. 3.*—On a line drawn between the present S. E. corner of the lower Gas Works pier (Tioga street) and the upper end of Petty Island, and distant on said line 1,100 feet southerly from the present S. E. corner of said pier. As day marks to indicate approximately the east and west limits of the said Port Richmond anchorage, there is erected near each end of Petty Island a post about 18 feet high, bearing at its summit a white board with the letter A painted thereon in black.

WAR VESSELS AND PLEASURE YACHTS.

War vessels of the United States and of foreign nations, and pleasure yachts, with permission of the Harbor Master, may anchor in such location as not to interfere with the navigation of the river.

Vessels must not anchor at any place in the channel of the River Schuylkill, nor lie at any wharf in that river more than two abreast, without the permission of the Harbor Master.

Vessels must not anchor on the range line of any range lights.

A vessel under one hundred and fifty feet in length, when at anchor, shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light in a lantern, so constructed as to show a clear, uniform and unbroken light, visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upwards in length, when at anchor, shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

3. Vessels hauled into any wharf or dock, or alongside of other vessels lying at any wharf or dock, must be made fast to the shore with

proper lines, with sufficient fenders between them and the inside vessels, and shall, when so ordered by the Harbor Master, have their jibbooms, booms, yards, davits and bumpkins, if any, rigged in, their lower yards topped, and anchors either a cockbill or at the hawse-pipe, as most convenient.

4. When fasts of vessels extend across a dock so as to obstruct passing vessels, the captain or person in charge shall, when so ordered by the Harbor Master, cause the fasts to be slackened or cast off.

5. Vessels lying at the ends of piers, so as to obstruct the passage to the adjoining docks, must move when necessary to accommodate other vessels entering or leaving the docks.

6. Vessels lying alongside of a wharf, and not taking in or discharging cargo, must make way for and permit other vessels that want to load or unload cargo to come inside next to the wharf.

7. If the person in charge of any vessel refuse to move, the Harbor Master shall cause the same to be done at the cost and risk of the master, owner or consignee.

8. No wharf shall be obstructed so as to prevent the loading or unloading of cargo, but reasonable facilities will at all times be allowed on application to the Harbor Master.

9. No tar, pitch, turpentine or resin shall be heated on a wharf, or on board any vessel lying at a wharf.

10. Vessels that may increase their width by using ballast-logs, pontoons or devices of the same nature, must move to accommodate other vessels when so ordered by the Harbor Master, and shall pay the expenses of other vessels that may be required to move to allow a vessel with the above appliances to get in or out of docks.

11. All sea-going vessels at anchor, or when discharging, loading, laying up or being repaired at any wharf in the Port of Philadelphia, are required to have and maintain a safe and convenient ladder, gang-plank or side-steps for the use of persons having business on board such vessels.

12. Any master, captain or whoever is in charge of a vessel, who shall refuse or neglect to comply with the directions of the Harbor Master, or whoever shall obstruct his authority, shall be fined in a sum not exceeding $100 for each and every offense.

JOSEPH H. KLEMMER,
Harbor Master.

Adopted by the Board of Wardens of the Port of Philadelphia, March 5, 1883, and amended February 5 and March 5, 1900.

Revised International Rules to Prevent Collisions at Sea.

The following New Rules for the Navigation of the High Seas, the outcome of the International Marine Conference, held in Washington, D. C., during the winter of 1889–90, were approved by Congress, and signed by the President, August 19th, 1890. The act took effect July 1st, 1897.

(See page 81 for Special Rules to be observed in Rivers, Harbors and Inland Waters.)

ACT OF AUGUST 19, 1890, TO ADOPT REGULATIONS FOR PREVENTING COLLISIONS AT SEA, AS AMENDED BY THE ACTS OF MAY 28, 1894, AUGUST 13, 1894, AND JUNE 10, 1896.

I.—Enacting Clause, Scope, and Penalty.

INTERNATIONAL RULES.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collisions at sea shall be followed by all public and private vessels of the United States upon the high seas and in all *waters connected therewith, navigable by sea-going vessels.*

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland *waters.*

Preliminary Definitions.

In the following rules every *steam-vessel* which is under sail and not under steam is to be considered a *sailing-vessel*, and *every vessel* under steam, whether under sail or not, is to be considered a *steam-vessel.*

The word "steam-vessel" shall include any vessel propelled by machinery.

A vessel is "under way" within the meaning of these rules when she is not at anchor, or made fast to the shore, or aground.

II.—Lights and So Forth.

The word "visible" in these rules when applied to lights shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The *rules concerning* lights shall be *complied with* in all weathers from sunset to sunrise, *and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.*

Steam-Vessels—Masthead Light.

ART. 2. *A steam-vessel* when under way shall carry—(a) On or in front of the foremast, *or if a vessel without a foremast, then in the fore part of the vessel*, at a height above the hull of not less than twenty feet, and if the breadth of the vessel exceeds twenty feet, then at a height above the hull not less than such breadth, *so, however, that the light need not be carried at a greater height above the hull than forty feet*, a

bright white light, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the *vessel*, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

Steam-Vessels—Side-Lights.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side-lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

Steam-Vessels—Range-Lights.

(e) *A steam-vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision* (a). *These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.*

Steam-Vessels When Towing.

ART. 3. A *steam-vessel* when towing another *vessel* shall, in addition to her side-lights, carry two bright white lights in a vertical line one over the other, not less than *six* feet apart, *and when towing more than one vessel shall carry an additional bright white light six feet above or below such light, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet.* Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a), *excepting the additional light, which may be carried at a height of not less than fourteen feet above the hull.*

Such steam-vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

Special Lights.

ART. 4. (a) A *vessel* which from any accident is not under command shall carry at the same height as a white light mentioned in article two (a), *where they can best be seen*, and if a *steam-vessel* in lieu of that light, *two red lights*, in a vertical line one over the other, not less than *six* feet apart, and of such a character as to be visible *all around the horizon* at a distance of at least two miles; and shall by day carry in a vertical line one over the other, not less than *six* feet apart, *where they can best be seen*, two black balls or shapes, each two feet in diameter.

(b) A *vessel* employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in article two (a), and if a *steam-vessel* in lieu of that light, three lights in a vertical line one over the other not less than six feet apart. The highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character as to be visible *all around the horizon, at a distance of at least two miles.* By day she shall carry in a vertical line, one over the other, not less than six feet apart, *where they can best be seen*, three shapes not less than two feet in diameter, of which the highest and lowest shall be globular in shape and red in color, and the middle one diamond in shape and white.

(c) The *vessels* referred to in this article, when not making way through the water, shall not carry the side-lights, but when making way shall carry them.

(d) The lights and shapes required to be shown by this article are to be taken by other *vessels* as signals that the *vessel* showing them is not under command and cannot therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in article thirty-one.

Lights for Sailing-Vessels and Vessels in Tow.

ART. 5. A *sailing-vessel* under way *and any vessel* being towed shall carry the same lights as are prescribed by article two for a *steam-vessel* under way, with the exception of the white lights mentioned therein, which they shall never carry.

Lights for Small Vessels.

ART. 6. Whenever, as in the case of small vessels *under way* during bad weather, the green and red side-lights cannot be fixed, these lights shall be kept *at hand, lighted and* ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, *nor, if practicable, more than two points abaft the beam on their respective sides.* To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

Lights for Small Steam- and Sail-Vessels and Open Boats.

"ART. 7. *Steam-vessels of less than forty, and vessels under oars or sails* of less than twenty tons *gross* tonnage, *respectively, and rowing boats,* when under way, shall not be *required* to carry the lights mentioned in article two (a), (b), and (c), but if they do not carry them they shall be provided with the following lights:

"*First. Steam-vessels of less than forty tons shall carry—*

"(*a*) *In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than nine feet, a bright white light constructed and fixed as prescribed in article two* (*a*), *and of such a character as to be visible at a distance of at least two miles.*

"(*b*) *Green and red side-lights constructed and fixed as prescribed in article two* (*b*) *and* (*c*), *and of such a character as to be visible at a distance of at least one mile, or a combined lantern showing a green light and a red light from right ahead to two points abaft the beam on their respective sides. Such lanterns shall be carried not less than three feet below the white light.*

"*Second. Small steamboats, such as are carried by sea-going vessels, may carry the white light at a less height than nine feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision one* (*b*).

"*Third. Vessels under oars or sails* of less than twenty tons shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

"*Fourth. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light, which shall be temporarily exhibited in sufficient time to prevent collision.*

"*The vessels referred to in this article shall not be obliged to carry the lights prescribed by article four* (*a*) *and article eleven, last paragraph.*"

Lights for Pilot-Vessels.

ART. 8. Pilot-vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side-lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side, nor the red light on the starboard side.

A pilot-vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

Pilot-vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other *vessels of their tonnage.*

Special Lights on Steam Pilot Vessels.

(Provisions of an Act approved Feb. 19, 1900, supplementary to Article 8.)

A steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white mast head light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights.

When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

Lights, etc., of Fishing-Vessels.

ART. 9. [Article nine, act of August 19, 1890, was repealed by act of May 28, 1894, and article 10, act of March 3, 1885, was re-enacted in part by act of August 13, 1894, and is reproduced here in part as article 9. It will be the object of further consideration by the Maritime powers.]

Fishing-vessels of less than twenty tons net registered tonnage, when under way and when not having their nets, trawls, dredges, or lines in the water, shall not be obliged to carry the colored side-lights; but every such vessel shall in lieu thereof have ready at hand a lantern with a green glass on the one side and a red glass on the other side, and on approaching to or being approached by another vessel such lantern shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

Lights for Fishing-Vessels Off European Coasts.

The following portion of this article applies only to fishing-vessels and boats when in the sea off the coast of Europe lying north of Cape Finisterre:

(*a*) All fishing-vessels and fishing-boats of twenty tons net registered tonnage or upward, when under way and when not having their nets, trawls, dredges, or lines in the water, shall carry and show the same lights as other vessels under way.

(*b*) All vessels when engaged in fishing with drift-nets shall exhibit two white lights from any part of the vessel where they can be best seen. Such lights shall be placed so that the vertical distance between them shall be not less than six feet and not more than ten feet, and so that the horizontal distance between them, measured in a line with the keel of the vessel, shall be not less than five feet and not more than ten feet. The lower of these two lights shall be the more forward, and both of them shall be of such a character and contained in lanterns of such construction as to show all around the horizon, on a dark night, with a clear atmosphere, for a distance of not less than three miles.

(*c*) All vessels when trawling, dredging, or fishing with any kind of drag-nets shall exhibit, from some part of the vessel where they can be best seen, two lights. One of these lights shall be red and the other shall be white. The red light shall be above the white light, and shall be at a vertical distance from it of not less than six feet and not more than twelve feet; and the horizontal distance between them, if any, shall not be more than ten feet. These two lights shall be of such a character and contained in lanterns of such construction as to be visible all around the horizon, on a dark night, with a clear atmosphere, the white light to a distance of not less than three miles, and the red light of not less than two miles.

(*d*) A vessel employed in line-fishing, with her lines out, shall carry the same lights as a vessel when engaged in fishing with drift-nets.

(*e*) If a vessel, when fishing with a trawl, dredge, or any kind of drag-net, becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall show the light and make the fog-signal for a vessel at anchor.

(*f*) Fishing-vessels may at any time use a flare-up in addition to the lights which they are by this article required to carry and show. All flare-up lights exhibited by a vessel when trawling, dredging, or fishing with any kind of drag-net shall be shown at the after-part of the vessel, excepting that if the vessel is hanging by the stern to her trawl, dredge, or drag-net, they shall be exhibited from the bow.

(*g*) Every fishing-vessel when at anchor between sunset and sunrise shall exhibit a white light, visible all around the horizon at a distance of at least one mile.

(*h*) In a fog a drift-net vessel attached to her nets, and a vessel when trawling, dredging, or fishing with any kind of a drag-net, and a vessel employed in line-fishing with her lines out, shall, at intervals of not more than two minutes, make a blast with her fog-horn and ring her bell alternately.

Lights for an Overtaken Vessel.

ART. 10. A *vessel* which is being overtaken by another shall show from her stern to such last-mentioned *vessel* a white light or a flare-up light.

The white light required to be shown by this article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon of twelve points of the compass, namely, for six points from right aft on each side of the vessel, so as to be visible at a distance of at least one mile. Such light shall be carried as nearly as practicable on the same level as the side-lights.

Anchor Lights.

ART. 11. A *vessel under one hundred and fifty feet in length* when at anchor shall carry *forward*, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upwards in length, when at anchor, shall carry *in the forward part of the vessel, at a height of not less than twenty and* not exceeding *forty* feet above the hull, one such light, *and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light.*

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fair-way shall carry the above light or lights and the two red lights prescribed by article four (a).

Special Signals.

ART. 12.—*Every vessel may, if necessary in order to attract attention, in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that cannot be mistaken for a distress signal.*

Naval Lights and Recognition Signals.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal-lights for two or more ships of war or for *vessels* sailing under convoy, *or with the exhibition of recognition signals adopted by ship-owners, which have been authorized by their respective Governments and duly registered and published.*

Steam-Vessel Under Sail by Day.

ART. 14. *A steam-vessel proceeding under sail only but having her funnel up, shall carry in day-time, forward, where it can best be seen, one black ball or shape two feet in diameter.*

III.—Sound Signals in Fog, Etc.

Preliminary.

ART. 15. *All signals prescribed by this article for vessels under way shall be given:*

First. By "steam-vessels" on the whistle or siren.

Second. By "sailing-vessels" and "vessels towed" on the fog horn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds' duration.

A steam-vessel shall be provided with an *efficient whistle or siren, sounded by steam or by some substitute for steam*, so placed that the sound may not be intercepted by any obstruction, and with an efficient fog horn, to be sounded by mechanical means, and also with an efficient bell. (In all cases where the rules require a bell to be used, a drum may be substituted on board Turkish vessels, *or a gong where such articles are used on board small sea-going vessels.*) *A sailing-vessel of twenty tons*

gross tonnage or upward shall be provided with a similar fog horn and bell.

In fog, mist, falling snow, *or heavy rainstorms*, whether by day or night the signals described in this article shall be used as follows, namely :

Steam-Vessel Under Way.

(a) *A steam-vessel having way upon her* shall sound, at intervals of not more than two minutes, a prolonged blast.

(b) *A steam-vessel under way, but stopped, and having no way upon her, shall sound, at intervals of not more than two minutes, two prolonged blasts, with an interval of about one second between.*

Sail-Vessel Under Way.

(c) A *sailing-vessel* under way shall sound, at intervals of not more than *one* minute, when on the starboard tack, one blast ; when on the port tack, two blasts in succession, and when with the wind abaft the beam, three blasts in succession.

Vessels at Anchor or Not Under Way.

(d) *A vessel* when *at anchor* shall, at intervals of not more than *one* minute, ring the bell *rapidly for about five seconds.*

Vessels Towing or Towed.

(e) A *vessel when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through being not under command, or unable to maneuver as required by the rules, shall, instead of the signals prescribed in subdivisions (a) and (c) of this article, at intervals of not more than two minutes, sound three blasts in succession, namely: One prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.*

Small Sailing-Vessels and Boats.

Sailing-vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals, but, if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

Speed in Fog.

ART. 16. Every *vessel* shall, in a fog, mist, falling snow, *or heavy rain-storms*, go at a moderate speed, *having careful regard for the existing circumstances and conditions.*

A steam-vessel hearing, apparently forward of her beam, the fog-signal of a vessel, the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

IV.—Steering and Sailing Rules.

Preliminary.

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

Sailing-Vessels.

ART. 17. When two *sailing-vessels* are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, namely :

(a) A *vessel* which is running free shall keep out of the way of a *vessel* which is close-hauled.

(b) A *vessel* which is close-hauled on the port tack shall keep out of the way of a *vessel* which is close-hauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the *vessel* which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the *vessel* which is to the windward shall keep out of the way of the *vessel* which is to the leeward.

(e) A *vessel* which has the wind aft shall keep out of the way of the other *vessel*.

Steam-Vessels.

ART. 18. When two *steam-vessels* are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article only applies to cases where *vessels* are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two *vessels* which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two *vessels* is end on, or nearly end on, to the other ; in other words, to cases in which, by day, each *vessel* sees the masts of the other in a line, or nearly in a line, with her own ; and by night, to cases in which each *vessel* is in such a position as to see both the side-lights of the other.

It does not apply by day to cases in which a *vessel* sees another ahead crossing her own course ; or by night, to cases where the red light of one *vessel* is opposed to the red light of the other, or where the green light of one *vessel* is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

Two Steam-Vessels Crossing.

ART. 19. When two *steam-vessels* are crossing, so as to involve risk of collision, the *vessel* which has the other on her own starboard side shall keep out of the way of the other.

Steam-Vessel Shall Keep Out of the Way of Sailing-Vessel.

ART. 20. When a *steam-vessel* and a *sailing-vessel* are proceeding in such directions as to involve risk of collision, the *steam-vessel* shall keep out of the way of the *sailing-vessel*.

Course and Speed.

ART. 21. Where, by any of these rules, one of two *vessels* is to keep out of the way the other shall keep her course *and speed*.

Note.—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision cannot be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. (*See articles twenty-seven and twenty-nine.*)

Crossing Ahead.

ART. 22. *Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.*

Steam-Vessel Shall Slacken Speed or Stop.

ART. 23. Every *steam-vessel which is directed by these rules to keep out of the way of another vessel* shall, on approaching her, if necessary, slacken her speed or stop or reverse.

Overtaking Vessels.

ART. 24. Notwithstanding anything contained in these rules, every *vessel*, overtaking any other, shall keep out of the way of the overtaken *vessel*.

Every vessel coming up with another vessel from any direction more than two points abaft her beam, that is, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side-lights, shall be deemed to be an overtaking vessel ; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel cannot always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

Narrow Channels.

ART. 25. In narrow channels every *steam-vessel* shall, when it is safe and practicable, keep to that side of the fair-way or mid-channel which lies on the starboard side of such *vessel*.

Rights of Way of Fishing-Vessels.

ART. 26. *Sailing-vessels under way shall keep out of the way of sailing-vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fair-way used by vessels other than fishing-vessels or boats.*

General Prudential Rule.

ART. 27. In obeying and construing these rules due regard shall be had to all dangers of navigation *and collision*, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

Sound Signals for Passing Steamers.

ART. 28. *The words "short blast" used in this article shall mean a blast of about one second's duration.*

When *vessels* are in sight of one another, a *steam-vessel* under way, in taking any course authorized or required by these rules, *shall* indicate that course by the following signals on her *whistle or siren*, namely:

One short blast to mean, "I am directing my course to starboard."

Two short blasts to mean, "I am directing my course to port."

Three short blasts to mean, "*My engines are* going at full speed astern."

Precaution.

ART. 29. Nothing in these rules shall exonerate any *vessel* or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

Reservation of Rules for Harbors and Inland Navigation.

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

Distress Signals.

ART. 31. When a *vessel* is in distress and requires assistance from other *vessels* or from the shore, the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime—

First. A gun *or other explosive signal* fired at intervals of about a minute.

Second. The international code signal of distress indicated by N C.

Third. The *distance* signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night—

First. A gun *or other explosive signal* fired at intervals of about a minute.

Second. Flames on the *vessel* (as from a burning tar barrel, oil barrel, and so forth).

Third. Rockets or shells throwing stars of any color or description, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

INLAND RULES.

(See page 89 for lines dividing high seas from rivers, harbors and inland waters.)

I.—Enacting Clause, Scope, and Penalty.

Whereas the provisions of chapter eight hundred and two of the laws of eighteen hundred and ninety, and the amendments thereto, adopting regulations for preventing collisions at sea [i. e. International rules], apply to all waters of the United States connected with the high seas navigable by sea-going vessels, except so far as the navigation of any harbor, river, or inland waters is regulated by special rules duly made by local authority; and

Whereas it is desirable that the regulations relating to the navigation of all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall be stated in one Act: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collision shall be followed by all vessels navigating all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and are hereby declared special rules duly made by local authority:

SEC. 3. That every pilot, engineer, mate, or master of any steam-vessel, and every master or mate of any barge or canal-boat, who neglects or refuses to observe the provisions of this Act, or the regulations established in pursuance of the preceding section [see section 2], shall be liable to a penalty of fifty dollars, and for all damages sustained by any passenger in his person or baggage by such neglect or refusal: *Provided*, That nothing herein shall relieve any vessel, owner or corporation from any liability incurred by reason of such neglect or refusal.

SEC. 4. That every vessel that shall be navigated without complying with the provisions of this Act shall be liable to a penalty of two hundred dollars, one-half to go to the informer, for which sum the vessel so navigated shall be liable and may be seized and proceeded against by action in any district court of the United States having jurisdiction of the offense.

Preliminary Definitions.

In the following rules every steam-vessel which is under sail and not under steam is to be considered a sailing-vessel, and every vessel under steam, whether under sail or not, is to be considered a steam-vessel.

The word "steam-vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

II.—Lights and So Forth.

The word "visible" in these rules, when applied to lights, shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

Steam-Vessels—Masthead Light.

ART. 2. A steam-vessel when under way shall carry—(a) On or in the front of the foremast, or, if a vessel without a foremast, then in the fore part of the vessel, a bright white light so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points

on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

Steam-Vessels—Side-Lights.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side-lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

Steam-Vessels—Range-Lights.

(e) A sea-going steam-vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (*a*). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance. (*f*) All steam-vessels (except sea-going vessels and ferry-boats), shall carry in addition to green and red lights required by article wo (b), (c), and screens as required by article two (d), a central range of two white lights; the after-light being carried at an elevation at least fifteen feet above the light at the head of the vessel. The head-light shall be so constructed as to show an unbroken light through twenty points of the compass, namely, from right ahead to two points abaft the beam on either side of the vessel, and the after-light so as to show all around the horizon.

Steam-Vessels When Towing.

ART. 3. A steam-vessel when towing another vessel shall, in addition to her side-lights, carry two bright white lights in a vertical line one over the other, not less than three feet apart, and when towing more than one vessel shall carry an additional bright white light three feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a) or the after-range light mentioned in article two (f).

Such steam-vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

Lights for Sailing-Vessels and Vessels in Tow.

ART. 5. A sailing-vessel under way or being towed shall carry the same lights as are prescribed by article two for a steam-vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

Lights for Ferry-Boats, Barges, and Canal-Boats in Tow.

SEC. 2. That the supervising inspectors of steam-vessels and the Supervising Inspector-General shall establish such rules to be observed by steam-vessels in passing each other and as to the lights to be carried by ferry-boats and by barges and canal-boats when in tow of steam-vessels, not inconsistent with the provisions of this Act, as they from time to time may deem necessary for safety, which rules when approved by the Secretary of the Treasury, are hereby declared special rules duly made by local authority, as provided for in article thirty of chapter eight hundred and two of the laws of eighteen hundred and ninety. Two printed copies of such rules shall be furnished to such ferry-boats and steam-vessels, which rules shall be kept posted up in conspicuous places in such vessels.

Lights for Small Vessels.

ART. 6. Whenever, as in the case of vessels of less than ten gross tons under way during bad weather, the green and red side-lights cannot be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light, which shall be temporarily exhibited in sufficient time to prevent collision.

Lights for Pilot-Vessels.

ART. 8. Pilot-vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side-lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot-vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

Pilot-vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other vessels of their tonnage.

Special Lights on Steam Pilot Vessels.

(Provisions of an Act approved Feb. 19, 1900, supplementary to Article 8.)

A steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white mast head light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights.

When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

Lights, etc., of Fishing-Vessels.

ART. 9. (a) Fishing-vessels of less than ten gross tons, when under way and when not having their nets, trawls, dredges, or lines in the water, shall not be obliged to carry the colored side-lights; but every such vessel shall, in lieu thereof, have ready at hand a lantern with a green glass on one side and a red glass on the other side, and on approaching to or being approached by another vessel such lantern shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side

(b) All fishing-vessels and fishing-boats of ten gross tons or upward, when under way and when not having their nets, trawls, dredges, or lines in the water, shall carry and show the same lights as other vessels under way.

(c) All vessels, when trawling, dredging, or fishing with any kind of drag-nets or lines, shall exhibit, from some part of the vessel where they can be best seen, two lights. One of these lights shall be red and the other shall be white. The red light shall be above the white light, and shall be at a vertical distance from it of not less than six feet and not more than twelve feet; and the horizontal distance between them, if any, shall not be more than ten feet. These two lights shall be of such a character and contained in lanterns of such construction as to be visible all around the horizon, the white light a distance of not less than three miles and the red light of not less than two miles.

The foregoing only applies to cases where vessels are meeting end on or nearly end on, in such a manner as to involve risk of collision ; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own, and by night to cases in which each vessel is in such a position as to see both the sidelights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course, or by night to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

RULE III. If, when steam-vessels are approaching each other, either vessel fails to understand the course or intention of the other, from any cause, the vessel so in doubt shall immediately signify the same by giving short and rapid blasts, not less than four, of the steam-whistle.

RULE V. Whenever a steam-vessel is nearing a short bend or curve in the channel, where, from the height of the banks or other cause, a steam-vessel approaching from the opposite direction can not be seen for a distance of half a mile, such steam-vessel, when she shall have arrived within half a mile of such curve or bend, shall give a signal by one long blast of the steam-whistle, which signal shall be answered by a similar blast, given by any approaching steam-vessel that may be within hearing. Should such signal be so answered by a steam-vessel upon the farther side of such bend, then the usual signals for meeting and passing shall immediately be given and answered ; but, if the first alarm signal of such vessel be not answered, she is to consider the channel clear and govern herself accordingly.

When steam-vessels are moved from their docks or berths, and other boats are liable to pass from any direction toward them, they shall give the same signal as in the case of vessels meeting at a bend, but immediately after clearing the berths so as to be fully in sight they shall be governed by the steering and sailing rules.

RULE VIII. When steam-vessels are running in the same direction, and the vessel which is astern shall desire to pass on the right or starboard hand of the vessel ahead, she shall give one short blast of the steam-whistle, as a signal of such desire, and if the vessel ahead answers with one blast, she shall put her helm to port ; or if she shall desire to pass on the left or port side of the vessel ahead, she shall give two short blasts of the steam-whistle as a signal of such desire, and if the vessel ahead answers with two blasts, shall put her helm to starboard ; or if the vessel ahead does not think it safe for the vessel astern to attempt to pass at that point, she shall immediately signify the same by giving several short and rapid blasts of the steam-whistle, not less than four, and under no circumstances shall the vessel astern attempt to pass the vessel ahead until such time as they have reached a point where it can be safely done, when said vessel ahead shall signify her willingness by blowing the proper signals. The vessel ahead shall in no case attempt to cross the bow or crowd upon the course of the passing vessel.

RULE IX. The whistle signals provided in the rules under this article, for steam-vessels meeting, passing, or overtaking, are never to be used except when steamers are in sight of each other, and the course and position of each can be determined in the daytime by a sight of the vessel itself, or by night by seeing its signal lights. In fog, mist, falling snow or heavy rainstorms, when vessels cannot see each other, fog-signals only must be given.

Supplementary Regulations.

SEC. 2. That the supervising inspectors of steam-vessels and the Supervising Inspector-General shall establish such rules to be observed by steam-vessels in passing each other and as to the lights to be carried by ferry-boats and by barges and canal-boats when in tow of steam-vessels, not inconsistent with the provisions of this act, as they from time to time may deem necessary for safety, which rules when approved by the Secretary of the Treasury, are hereby declared special rules duly made by local authority, as provided for in article thirty of chapter eight hundred and two of the laws of eighteen hundred and ninety. Two printed copies of such rules shall be furnished to such ferry-boats and steam-vessels, which rules shall be kept posted up in conspicuous places in such vessels.

Two Steam-Vessels Crossing.

ART. 19. When two steam-vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

Steam-Vessel Shall Keep Out of the Way of Sailing-Vessel.

ART. 20. When a steam-vessel and a sailing-vessel are proceeding in such directions as to involve risk of collision, the steam-vessel shall keep out of the way of the sailing-vessel.

Course and Speed.

ART. 21. Where, by any of these rules, one of the two vessels is to keep out of the way, the other shall keep her course and speed.

[See articles 27 and 29.]

Crossing Ahead.

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

Steam-Vessel Shall Slacken Speed or Stop.

ART. 23. Every steam-vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

Overtaking Vessels.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam, that is, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side-lights, shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel cannot always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

Narrow Channels.

ART. 25. In narrow channels every steam-vessel shall, when it is safe and practicable, keep to that side of the fair-way or mid-channel which lies on the starboard side of such vessel.

Rights of Way of Fishing-Vessels.

ART. 26. Sailing-vessels under way shall keep out of the way of sailing-vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fair-way used by vessels other than fishing-vessels or boats.

General Prudential Rule.

ART. 27. In obeying and construing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

Sound Signals for Passing Steamers.

(See Art. 18.)

ART. 28. When vessels are in sight of one another a steam-vessel under way whose engines are going at full speed astern shall indicate that fact by three short blasts on the whistle.

Precaution.

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

Lights on United States Naval Vessels and Revenue Cutters.

ART. 30. The exhibition of any light on board of a vessel of war of the United States or a revenue cutter may be suspended whenever, in the opinion of the Secretary of the Navy, the commander in chief of a squadron, or the commander of a vessel acting singly, the special character of the service may require it.

Distress Signals.

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the Daytime.

A continuous sounding with any fog-signal apparatus, or firing a gun.

At Night.

First. Flames on the vessel as from a burning tar barrel, oil barrel, and so forth.

Second. A continuous sounding with any fog-signal apparatus, or firing a gun.

INLAND WATERS WHERE THE INLAND RULES OF THE ROAD ARE TO BE FOLLOWED.

The United States Treasury Department has given notice, dated July 12, 1900, that pursuant to Section 2 of the Act approved February 19, 1895, the following lines dividing the high seas from rivers, harbors, and inland waters are hereby designated and defined, to take effect October 1, 1900:

(All bearings are magnetic and given approximately.)

Cutler (Little River) Harbor, Me.

A line drawn from Long point SW. by W. ¾ W. to Little River head.

Little Machias Bay, Machias Bay, Englishman Bay, Chandler Bay, Moosabec Reach, Pleasant Bay, Narraguagus Bay, and Pigeon Hill Bay, Me.

A line drawn from Little River head W SW. ¼ W. to the outer side of Old Man; thence W SW. ⅜ W. to the outer side of Double Shot Islands; thence W. ¾ S. to Libby Islands lighthouse; thence W S.W ¼ W. to Moose Peak lighthouse; thence W SW. ¼ W. to Little Pond head; from Pond point, Great Wass Island, W. by S. to outer side of Crumple Island; thence W. ⅜ S. to Petit Manan lighthouse.

All Harbors on the Coasts of Maine, New Hampshire, and Massachusetts, Between Petit Manan Lighthouse, Me., and Cape Ann Lighthouses, Mass.

A line drawn from Petit Manan lighthouse S W. ⅜ S., 26½ miles, to Mount Desert lighthouse; thence W. ⅜ S. 33½ miles, to Matinicus Rock lighthouses; thence W NW. ⅞ W., 20 miles to Monhegan Island lighthouse; thence W. 21 miles, to Seguin Island whistling buoy; thence W. ¾ S., 19 miles, to Old Anthony whistling buoy, off Cape Elizabeth; thence SW., 28 miles, to Boon Island lighthouse; thence SW. ⅛ W., 12 miles to Anderson Ledge spindle, off Isles of Shoals lighthouse, thence S. by W. ¼ W., 19½ miles, to Cape Ann lighthouses, Mass.

Boston Harbor.

From Point Allerton N NE. ¼ E., easterly through Point Allerton beacon to Northeast Grave whistling buoy; thence N NE. ¼ E. to Outer Breaker (Great Pig Rocks) bell buoy; thence NE. by E. ⅜ E. to Halfway Rock beacon; thence NE. by E. ¼ E. to Eastern Point lighthouse.

All Harbors in Cape Cod Bay, Mass.

A line drawn from Plymouth (Gurnet) lighthouses E., 16¼ miles, to Race Point lighthouse.

Nantucket Sound, Vineyard Sound, Buzzards Bay, Narragansett Bay, Block Island Sound, and Eastern Entrance to Long Island Sound.

A line drawn from Chatham lighthouses, Mass., S. by E. ⅜ E., about 6 miles, to Northeast Slue Channel whistling buoy (Pollock rip); thence S. by W. ⅝ W. about 11 miles, to Great Round Shoal lightvessel; thence S SW. ⅝ W., 7⅝ miles, to Sankaty Head lighthouse; from the western end of Tuckernuck Island NW. by W. ½ W., about 5½ miles, to Wasque Point, Chappaquiddick Island; from Gay Head lighthouse W. ¾ S. 35 miles to Block Island (SE.) lighthouse; thence W. ¾ S., 15 miles, to Montauk Point lighthouse, on the eastern end of Long Island, N. Y.

New York Harbor.

From Navesink (southern) lighthouse NE. ⅝ E., easterly, to Scotland lightvessel; thence N NE. ½ E. through Gedney Channel whistling buoy to Rockaway Point life-saving station.

Philadelphia Harbor and Delaware Bay.

From Cape Henlopen lighthouse E NE. ½ E. to Overfalls lightvessel; thence N NE. ¼ E. to Cape May lighthouse.

Baltimore Harbor and Chesapeake Bay.

From Cape Henry lighthouse NE. by E. ¾ E., easterly, to Outer Entrance whistling buoy; thence N. by E. ⅛ E. to Cape Charles lighthouse.

Charleston Harbor.

From Charleston lightvessel N. ⅝ E. to Rattlesnake Shoal west buoy; thence W. ½ N. to the west end of the North jetty; and from Charleston lightvessel about SW. ⅛ W. through Charleston whistling buoy (proposed position) until Charleston lighthouse bears N NW. ½ W.; thence W. to Folly Island.

Savannah Harbor and Calibogue Sound.

From Tybee whistling buoy N NW. 1⅛ W. through North Slue Channel outer buoy to Braddock Point, Hilton Head Island, and from Tybee whistling buoy W. to Tybee Island.

St. Simon Sound (Brunswick Harbor) and St. Andrew Sound.

From hotel on beach of St. Simon Island 1⅛ mile NE. by E. ¼ E.

from St. Simon lighthouse, SE. 7/8 E, to St. Simon sea buoy; thence S. 1/4 E. to St. Andrew Sound sea buoy; thence W. to the shore of Little Cumberland Island.

St. John's River, Fla.

A straight line from the outer end of the northern jetty to the outer end of the southern jetty.

Charlotte Harbor and Punta Gorda, Fla.

Eastward of the Entrance bell buoy off Boca Grande, and in Charlotte Harbor in Pine Island Sound and Matlacha Pass. Pilot rules for western rivers apply in Peace and Myacca rivers north of a W SW. and E NE. line through Mangrove Point beacon light; and in Caloosa river when northward of the steamboat wharf at Punta Rasa.

Tampa Bay and Tributaries, Fla.

From the south end of Long key SW. 3/4 W. to the whistling buoy; thence SE. 3/4 S. to the Bar bell buoy at the entrance to Southwest channel; thence E. 3/4 S. to the north end of Anna Maria or Palm key. Pilot rules for western rivers apply in Manatee river when inside the black and white perpendicularly striped Entrance buoy; in Hillboro river when inside Barrel Stake beacon light.

St. George Sound, Apalachicola Bay, Carrabelle and Apalachicola Rivers, and St. Vincent Sound, Fla.

North of a line from Lighthouse Point SW. by W. 3/4 W. to the southeastern end of Dog Island; to the northward of the black and white perpendicularly striped outer buoy at the entrance to East pass, and inside the black and white perpendicularly striped buoy at the seaward entrance to West pass. Pilot rules for western rivers apply in Carabelle river and when on the range and crossing the bar at the entrance; in Apalachicola river and northward of Five-Foot Lump buoy when crossing the bar.

Pensacola Harbor.

From Pensacola Entrance whistling buoy N. 7/8 W., a tangent to the E. side of Fort Pickens, to the shore of Santa Rosa Island, and from the whistling buoy NW 3/16 W. to Fort McRee Range front light.

Mobile Harbor and Bay.

From Mobile Bay Outer or Deep Sea whistling buoy (or its watch buoy in summer) NE. by N. to the shore of Mobile Point, and from the whistling buoy NW. by W. to the shore of Dauphin Island. Pilot rules for western rivers apply in Mobile River above Battery Gladden.

Sounds, Lakes, and Harbors on the Coasts of Alabama, Mississippi, and Louisiana, Between Mobile Bay Entrance and the Delta of the Mississippi River.

From Sand Island lighthouse W SW. ½ W. (approximately) to Chandeleur lighthouse; westward of Chandeleur and Errol Islands, and west of a line drawn from the southwest point of Errol Island, south (approximately) to Pass a Loutre lighthouse. Pilot rules for western rivers apply in the Pascagoula River and in the dredged cut at the entrance to the river, above the outside beacon marking the dredged cut.

New Orleans Harbor and the Delta of the Mississippi.

From South Pass East jetty N. by E. ½ E. to Pass a Loutre lighthouse; thence N. to Errol Island and from South Pass East jetty light W. ⅞ S. to Southwest Pass lighthouse; thence N. to shore. Pilot rules for western rivers apply in the Mississippi River above the lower limits of the city of New Orleans.

Sabine Pass, Tex.

Pilot rules for western rivers apply to Sabine Pass northward of Sabine Pass whistling buoy and in Sabine Lake and its tributaries. Outside of this buoy the International Rules apply.

Galveston Harbor.

From Galveston Bar whistling buoy N. by W. ⅞ W. through the beacon marking the outer extremity of the N. jetty, and W SW. to the Tremont House, Galveston City.

Brazos River, Tex.

Pilot rules for western rivers apply in the Brazos River above the outer ends of the jetties. International Rules apply outside the ends of the jetties.

San Diego Harbor.

From Point Loma lighthouse S. ⅞ E. to San Diego Bay Outside Bar whistling buoy; thence N NE. ⅞ E. to tower of Coronado Hotel.

San Francisco Harbor.

From Point Bonita lighthouse SE. ⅞ S. to Point Lobos.

Columbia River Entrance.

From Cape Disappointment light SE. ⅞ E. to Point Adams light.

NOTE.—The above notice cancels previous H. O. Notices to Mariners relating to the same subject.

MARITIME METEOROLOGY.

BY THOMPSON B. MAURY, PHILA.

1. The winds of the globe between the Arctic and Antarctic circles may be classified as two distinct systems. Within the tropics they blow from east to west, as Columbus noted on his first voyage to America. But within the temperate zones they blow generally from west to east. The winds in the middle latitudes are called "variables," in opposition to the constant trade winds, and are from southwest in the north temperate zone and from northwest in the south temperate zone. Their direction, however, is largely decided by the great, moving barometric waves and storm centres.

2. The winds of the Atlantic are not influenced by any mountain-chain skirting its shores, as the Andes, which exert so great an influence on the winds of the Pacific. American research shows that the northeast trade-wind belt extends much further to the north on the eastern side of the Atlantic than near the American coast. The trade-wind belt is narrower about 40 degrees west than further eastward, except in summer. The direction of the trades is much more easterly in the western than in the eastern part of the Atlantic. The southeast trade is drawn across the Equator and gradually changed into a south and southwest wind, densely charged with moisture. Between the Cape of Good Hope and Cape St. Roque is a peculiar streak of powerful southeast trades.

3. The winds of the Atlantic coast of North America, from Labrador to Florida, are mostly southwest in summer and northwest in winter. In summer, however, they are more southerly and southeasterly near Florida than in New England, and in winter more frequently northwest in New England than in the Middle and South Atlantic States. In autumn they are more northerly in the South Atlantic States than in winter. From New York to Virginia the prevailing direction is WSW., inclining most to the north in February and most to the south in August.

In the Gulf of Mexico the winds on the northern shore are rather northeasterly in autumn, but southerly and southeasterly in spring and summer, when they are more regular than the northeasterly winds of winter. "Northers" occur from September to June.

Hurricanes or Cyclones.

1. Storms seem generally to follow the course of the prevailing winds, as eddies in running water travel down stream. In the tropics they move from east to west, on lines curving towards higher latitudes; when well past the tropics their paths incline to the eastward. Two storms, if near each other, tend to converge, and become more violent.

2. We know from the weather maps of the United States Weather Bureau that American and Atlantic storms travel in the long belt of low barometric pressure, lying between the areas of high pressure, the space between serving as a groove for the passage of the cyclone. A storm centre apparently cannot run through a bank of high pressure; when it meets such a bank it is delayed, or else goes around it.

3. A hurricane in passing over an island is apt to be broken up or weakened, and if it runs far inland is likely to lose its force or disappear. It needs much vapor to enable it to keep up its violence, and this it cannot get on land. As the process of evaporation from the sea-surface is rapidly carried on, both by solar energy and by the agency of high westerly winds in the middle latitudes, and consequently aqueous vapor enormously supplied to passing storm centres, their intensity is greatest near the Equatorial Currents on their western sides, and in the middle latitudes where the counter-trades blow most fiercely.

4. Storms pursue the track over which rain is falling heavily. At sea, therefore, when, with a falling barometer, a ship enters a torrential rain, she is probably in the track of an approaching gale. If rain falls in large quantities in any quadrant of cyclone, the pressure will diminish and the violence of the gale will increase in that quadrant.

5. United States storms generally advance from the Upper Mississippi Valley towards New York and New England, less frequently towards Virginia, and seldom towards the Carolinas. American storm-centres most frequently pass off the coast between 45 degrees and 50 degrees north latitude. When passing near Newfoundland they often slow up.

6. The great waves of high barometer with fierce northwest winds in their front usually advance from the Rocky Mountains towards Virginia and the Carolinas, but less frequently towards New England. They mostly move southeasterly.

7. In an area of high barometer north of the Equator the winds rotate in the same direction as the hands of a clock. In a cyclone they rotate apparently in a direction contrary to the hands of a clock. South of the Equator these directions are respectively reversed. There is generally a brief calm at the centre of the hurricane. The cyclone must not be thought of only as a rotating disc, propelled mechanically from parallel to parallel; but also as an atmospheric eddy, which dies out in its rear, but is rapidly renewed in its front, and thus propagated forward by the fall of the barometer.

8. The rate of a hurricane's advance varies from 10 to 40 miles an hour, being slow in the tropics till it recurves. North Atlantic storms, according to American investigations, progress on an average about 15 miles an hour; near Newfoundland they are usually delayed, but after they pass it they increase in velocity and force. Cyclones seldom, if ever, cross the Equator. In the West Indies, before recurving, their most dangerous winds are NE. and ENE. While recurving, off the Bahamas and Florida, the highest winds are E., ESE. and SE. Off the coast of the United States they are SE. to NE.

9. The shape of cyclones is seldom circular, but rather oval or elliptical, and their diameter (which is small in the tropics) is from 100 to 300 miles usually, after they get into higher latitude. Frequently cyclonic or other eddies seem to form and play around the borders of the main hurricane, from which they are offshoots.

10. Cyclones sometimes become stationary, and even go backward. When thus delayed, especially if in the vicinity of the Gulf Stream, or near warm open seas, on resuming their proper course they are more dangerous than they were before.

Hints for Handling Ships in or Near Cyclones.

1. The signs of a hurricane's approach are, first, an increase of ocean swell from its forerunning storm-wave, red or copper-colored sky, lunar halo, sea rising in waves without wind and sometimes growing warmer, with stronger smell. Threads of fine, wavy, cirrus cloud appear upon the S. W. horizon, moving apparently parallel to the horizon; an easterly wind springs up suddenly, when the higher clouds begin to move from a more southerly point. When these last occur north of the Equator, a ship is directly in the storm track. The thermometer rises, and the barometer, after having first become unsteady, or rising slightly, begins to fall rapidly. With sultry, oppressive atmosphere, the sky is thick and hazy in the direction of the hurricane; the wind moans, becomes puffy, and blows in gusts, indicating that it is not far off. If from the cloud-bank overhanging the storm, shreds of cloud are seen projected forwards and upwards, as if by some violent ascensional movement of air, the storm-centre is dangerously near.

But, perhaps, the most timely and trusty indication of a cyclone is often the rise of the thermometer coupled with a reversal of the normal wind. Thus, in the trade-wind belts, a fresh westerly wind suddenly springing up should at once arouse suspicion, particularly in the hurricane season, which, in the West Indies, the China Sea and Bay of Bengal, is from July to October. Equally suspicious is

a strong easterly wind suddenly succeeding the normal westerly winds between 40 degrees and 50 degrees N., on the routes from the United States to Europe. Scarcely anything except the indraught of a deep depression can be supposed to cause the sudden change of the East Indian monsoon, in August and September. A cautious seaman, therefore, with his wind-chart before him, may very frequently, it would seem, by attending to the abnormal and sudden change of wind-direction, foresee that he is in front of a revolving gale, though his barometer remains high, the sea smooth and none of the usual signs of hurricanes can be distinguished overhead.

The Mexican "Northers" are indicated by unusually fine precedent weather, a light bank of clouds in the north, followed, perhaps, by a faint northerly breeze, wind coming in puffs, and barometer always rising. After the norther has apparently ceased, it is dangerous to go to sea, unless the barometer has fallen to about 30.00 or 30.05 inches.

2. The winds within a cyclone do not blow in perfect circles, nor in straight lines, but rather in irregular spirals. They blow in a more circular direction on the outside of the cyclone than near its centre. The nearer they get to the central area, the more does their direction resemble that of the spokes of a wheel. In the North Atlantic there is reason to think the strongest storm winds are in the SE. quadrant; in winter the strongest winds are probably oftener in the N. W. quadrant of the depression. The storm-winds, though they are subjected to both a centrifugal and to a centipedal deflecting force, of course all incurve towards the storm-centre.

3. To Find the Direction of the Centre.—The centre does not always bear at right angles to the direction of the wind. In the Northern Hemisphere, with your face to the wind, the centre is from 10 to 12 points to the right-hand side. In the Southern Hemisphere the angle is to be measured to the left-hand side; but in both hemispheres it is to be reckoned in a direction opposite to the storm's rotation. In a word, running a line from the ship at an angle of about 60 degrees or 65 degrees, with the wind direction, you will find the approximate bearing of the cyclone's centre. If, however, the ship has already gotten into the gale, the angle may be much less than 60 degrees—say, eight or nine points.

As the winds do not blow in circles around the storm-centre, it will probably not be very far from the truth if we assume that in both hemispheres the higher storm-winds (say, of force 6, velocity 45 miles an hour) make, with a line drawn from the ship to the centre, an angle of about 45 degrees. Lighter winds make a greater angle, and those of force 7, velocity 60 miles an hour, a lesser angle. These figures are, of course, somewhat conjectural, and the angles made very variable. But, as rough approximations, they may give some idea of the general bearing of the centre of danger. In fine, we can only tell on which side of the ship the gale is, by carefully noting the shifts of the wind, always remembering that, if it does not shift decidedly, the ship is dangerously near to, or in the storm's track.

4. To avoid the centre of a cyclone, the most important point is not to run before the wind, which blows toward the centre. For ships known to be in front of a Northern Hemisphere hurricane and on its track, the best rule is to keep the wind well on the starboard quarter. In south latitude the wind should be kept well on the port quarter, if the ship is known to be anywhere in front of a typhoon or hurricane. This rule holds good generally, and the wind should be kept on the ship's quarter as much as it is possible without causing her "broaching to." To carry on with a fair wind when haze, sea-swell and sky-indications show that the ship is threatened by a gale is unjustifiable; far better to "heave to" and watch the sky, wind, sea and barometer.

All positive rules, of course, are defective, and if blindly carried out, may be very dangerous to the mariner. But, in the present state of ocean meteorology the most trustworthy data substantially sustain the above deductions. By keeping on the port tack and running or scudding directly with the wind in front of a North Atlantic cyclone a ship must almost certainly get entangled in its central disturbance. By keeping the wind on the starboard quarter, as well as circumstances permit, and her searoom will justify, she will usually be most likely to edge her way toward a calmer sea and a clearer sky.

Supposing, then, a navigator has good reason to believe that he is running

some distance in front of a North Atlantic hurricane, let him look the wind square in the face, and measure around to his right-hand side about 12 points of the compass. The twelfth point will indicate approximately the direction of the centre. Knowing where the chief danger lies, he can act accordingly. As hurricanes are sometimes impelled or propagated forward from 40 to 50 miles an hour, it is unsafe to attempt to cross the path in front of the depression.

5. As the cyclonic winds probably blow harder and more directly toward the centre, the nearer they get to the central vortex, it is more necessary that a ship should increase her distance from the centre in the very beginning of the gale, when it is more practicable to keep the wind on her quarter. A ship running before the wind will sometimes have the storm-centre bearing about 25 or 30 degrees (2 or 3 points) before her port beam ; hence she will be running into the most dangerous part of the storm. A distance of ten miles may occasionally (especially if the ship is near the West Indies) make all the difference between losing a few spars and foundering.

As the westerly winds that rush in behind a retreating depression are offshoots from high-pressure waves, moving from high to low latitudes, it seems clear that, after a storm-centre passes the ship, the more northing she can make in the N. Hemisphere (and the more southing in the S. Hemisphere), the lighter will be the force of the winds, the less westerly will they be, and the sooner she will find a moderate sea.

6. A course for avoiding the heart of the storm is not all to be considered. At the outset of the gale the vessel should be put on a course most favorable for safely encountering the unavoidable after-part of the gale, and for the ultimate prosecution of her voyage. Such a variable course seems often to be preferred, as will enable her safely to meet, or to render available the succeeding changes of wind.

7. As cyclones sometimes remain stationary, and even return on their paths, it is unsafe to follow closely on their heels in hope of profiting by the storm-winds.

If a vessel is caught in the centre of a hurricane and compelled to lie to, there seems to be no course better than to heave to on the starboard tack in north latitude (and on the opposite tack in south latitude), taking every precaution possible to meet the N. N. W., or N. W'ly winds that may be expected very quickly to burst forth. But no absolute rule can be laid down to meet this case. By watching the tendency to shift, which the wind manifests, we can tell very nearly what the subsequent violent and perilous shifts will be ; and this suggestion must be a seaman's guide.

Researches in Ocean Meteorology.

The United States Government is conducting an extensive system of ocean, as well as of land, meteorological observations through its Weather Bureau. It seeks the co-operation of all navigators, requesting them to take one observation every day at a prescribed moment, which is simultaneous for every part of the globe. These simultaneous observations are charted and published by the Weather Bureau at Washington, in its International Weather Charts and Bulletins, copies of which, with other publications of the Weather Bureau, are sent regularly by mail, without charge, to every seaman taking the observations and forwarding them to the Chief of Weather Bureau, Washington, D. C. By entering into this arrangement and taking part in the observational work, every seaman may contribute materially to this scientific enterprise and further the elucidation of the "law of storms," as well as securing for his own use a large supply of valuable nautical information. Blanks for entering the observations (and instruments also, if necessary) are furnished to ship-captains, and it is hoped that all captains interested in meteorology will enlist in the service.

EXPLANATION OF STORM AND WIND-DIRECTION SIGNALS

Displayed at various points on the coasts of the United States.

The Signals are as follows:

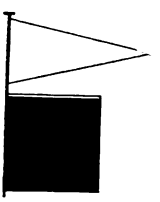
STORM

A red flag with black centre—indicates that storm is expected to be severe.

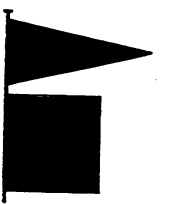
HURRICANE

Two red flags with black centres—indicates expected approach of tropical hurricane.

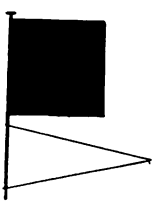
The Pennants, when displayed with the flags, indicate the direction from which the wind is expected, as follows:



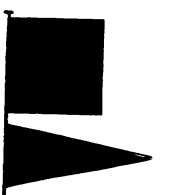
NORTHWESTERLY WINDS



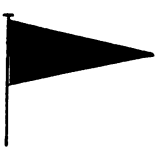
NORTHEASTERLY WINDS



SOUTHWESTERLY WINDS



SOUTHEASTERLY WINDS



INFORMATION SIGNAL

Consists of a red pennant, displayed alone, and indicates that the local observer has received information from the central office of a storm covering a limited area, and dangerous only for vessels about to sail to certain points. The signal is intended to be a notification to shipmasters that valuable information will be given them on application to the local observer.

BY NIGHT:

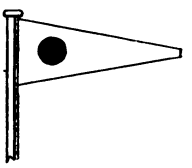
A RED light will indicate easterly winds.
A WHITE light above a RED light will indicate westerly winds.

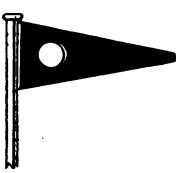
The system of weather, temperature and rain signals displayed throughout the country is distinct from the storm and wind-direction signals, the latter being principally for the information of maritime interests, and displayed at the principal ports on the coasts.

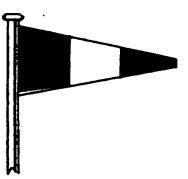
THE NEW INTERNATIONAL CODE OF SIGNALS.

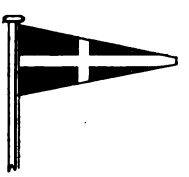
*A

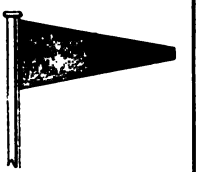
B

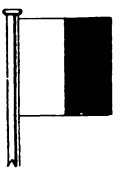
C 

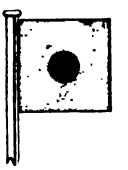
D 

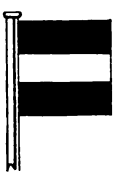
*E 

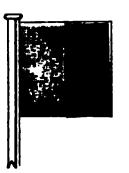
*F 

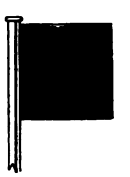
G 

H 

*I 

J 

*K 

*L 

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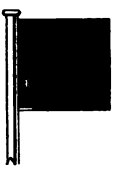
*O 

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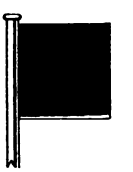
Q 

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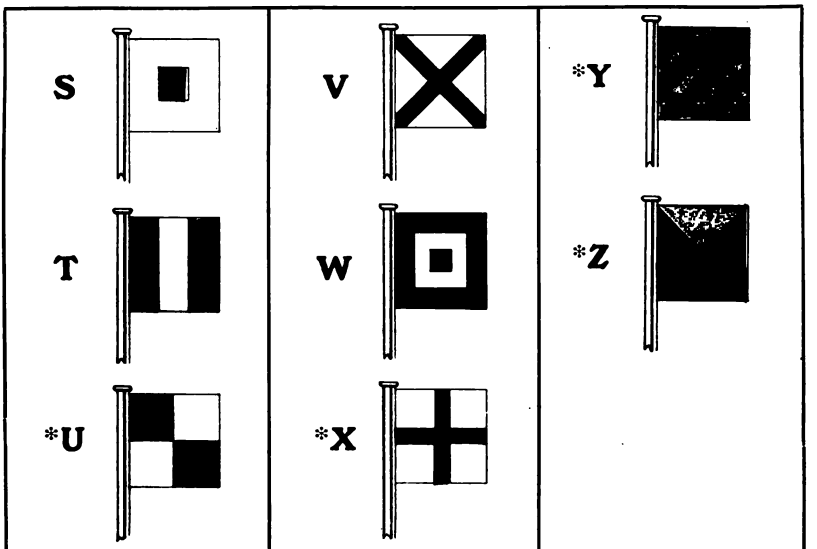
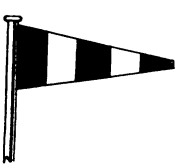


"CODE FLAG" AND "ANSWERING PENNANT."

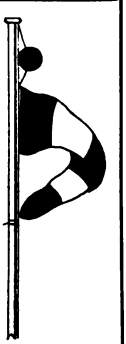


When used as the "Code Flag" it is to be hoisted under the ensign.

When used as the "Answering Pennant" it is to be hoisted at the masthead or where best seen.

"DISTINGUISHING SIGNAL."

Until the final abolition of the old Code, on **January 1, 1902,** *all vessels using this (the new) Code are to hoist as their Code Signal, or Answering Signal, the Code Flag* WITH THE FLY TIED TO THE HALYARDS, *having above it a black ball, or shape resembling a ball.*



The New International Code of Signals will come into force on January 1, 1901.

From January 1, 1901, to January 1, 1902, the use of the New Code will be optional; vessels using it must hoist the DISTINGUISHING SIGNAL, as shown above.

After January 1, 1902, only the New Code will be used.

The New Code requires twenty-seven flags in all; seventeen flags of the old code being retained, and ten new flags added. Each of the ten new flags is shown above marked with a star (*).

We are prepared to furnish promptly, full sets, or any part of a set, of the above flags, of the best quality, (material and workmanship guaranteed) at moderate prices, and shall be pleased to furnish estimates of cost of same on application.

The New Code Books are now being prepared, and as soon as issued may be obtained from us.

RIGGS *and* BROTHER

310 Market Street

Philadelphia

RIGGS' Ornamental Compensating Yacht Binnacle

"JOSEPHINE" PATTERN

(With Hand's Patent Compensation)

The demand for an ornamental Yacht Binnacle that would combine Mr. John E. Hand's patent system of compensation (see page 112) with our new style of plate glass hood, has induced us to place on the market the Binnacle illustrated above.

The stand is of polished mahogany, handsomely carved; the quadrantal correctors are incased in brass globes and all metal parts are polished brass, producing a binnacle that cannot be excelled.

The system of compensation is acknowledged to be the best.

Price, complete, with 8-in Ritchie Compass $250.00

This is the regular size; other sizes made to order at short notice.
Fitted for either oil or electric light, as desired.

Instructions to Masters of Stranded Vessels, for Obtaining Help From the Life-Saving Service.

In the event of a vessel stranding on the coasts of the United States or of the United Kingdom, and the lives of the crew being placed in danger, assistance will, if possible, be rendered from the shore in the following manner, namely :

1.—A rocket or shot, with a thin line attached, will be fired across the vessel. Get hold of this line as soon as possible, and when you have secured it, let one of the crew be separated from the rest, and, if in the daytime, wave his hat or his hand, or a flag or handkerchief; or, if at night, let a rocket, a blue light, or a gun be fired, or let a light be displayed over the side of the ship and be again concealed, as a signal to those on shore.

2.—When you see one of the men on shore separated from the rest, wave a red flag, or (if at night) show a red light and then conceal it, haul upon the rocket line until you get a tail block with an endless fall rove through it.

3.—Make the tail of the block fast to the mast about 15 feet above the deck, or, if the masts are gone, to the highest secure parts of the vessel. When the tail block is made fast and the rocket line unbent from the whip, let one of the crew separated from the rest, make the signal required by Article 1.

4.—As soon as the signal is seen on shore, a hawser will be bent to the whip line, and will be hauled off to the ship by those on shore.

5.—When the hawser has been got on board, the crew should at once make it fast to the same part of the ship that the tail block is made fast to, only about 18 inches higher, taking care that there are no turns of the whip line around the hawser.

6.—When the hawser has been made fast on board, the signal directed to be made in Article 1 is to be repeated.

7.—The men on shore will then pull the hawser taut, and by means of the whip line will haul off to the ship a sling life-buoy, or life-car, into which the person to be hauled ashore is to get and be made fast. When he is in and secure, one of the crew must be separated from the rest, and again signal to the shore, as directed in Article 1. The people on shore will then haul the person in the sling to the shore, and when he has landed will haul back the empty sling, life-buoy or life-car to the ship for others. This operation will be repeated until all persons are hauled ashore from the wrecked vessel.

8.—It may sometimes happen that the state of the weather and the condition of the ship will not admit of a hawser being set up ; in such cases a sling life-buoy will be hauled off instead, and the shipwrecked persons will be hauled through the surf, instead of along a hawser.

Masters and crews of stranded vessels should bear in mind that success in landing them in a great measure depends upon their coolness and attention to the rules here given.

The system of signaling must be strictly adhered to, and all women, children, passengers, and helpless persons should be landed before the crew of the ship.

LIGHTS OF THE WEST INDIES

GULF OF MEXICO, CENTRAL AND SOUTH AMERICA

[*Revised and Corrected to December 1, 1900.*]

ABBREVIATIONS AND EXPLANATIONS

LIGHTS.

F.—Fixed. Continuously steady and visible.

Fl.—Flashing. Flashes or groups of flashes. A flash means a flood of light instantaneously appearing and disappearing.

F. & Fl.—Fixed and Flashing. The flash may occur during the continuance of the fixed light, which it intensifies, or the latter may show for an interval and then be eclipsed for an interval, during which the flashes will appear.

Rev.—Revolving. Light appears and gradually increases to full effect, and then gradually decreases to eclipse. (At short distances and during clear weather, instead of an eclipse a faint continuous light may be observed.)

Int.—Intermittent. Suddenly appearing in view, remaining steady and visible for a certain time, and then as suddenly eclipsed for a time. (This term includes occulting.)

Alt.—Alternating. Red and white light, alternately, at equal intervals, without any intervening eclipse.

The bearings are *true*, and are given *from* the ship, *not from* the light.

Measurements are given in English feet, yards and nautical miles.

The distance the lights are visible is calculated from a height of fifteen feet above the level of the sea at high water. The *actual* visibility of a light is more or less dependent on its power or intensity.

Lights are to be considered as *white* unless otherwise stated.

NAME.	LOCATION.	LATITUDE North.	LONGITUDE West.	Description of Light.	Interval of Flash.	Distance visible in nautical miles.	Color of Tower or Vessel.	Height of Light above the Sea.
BERMUDA ISLANDS.		° ′ ″	° ′ ″		m. s.			
Gibbs Hill		32 15 05	64 49 40	Rev.	1.00	24	White.	362
St. David Island	Mount Hill	32 21 40	64 38 40	F.		20	White.	208
BAHAMA ISLANDS.								
Great Isaac	On the island	26 02 00	79 06 00	Rev.	30	16	Red & white.	158
Gun Cay	Near S. point	25 34 30	79 18 26	Rev. red.	1.30	12	Red & white.	80
Great Stirrup Cay	1,800 feet from E. end of cay.	25 49 40	77 53 55	F.		15	Red & white.	81
Abaco Island. Hole in the Wall.	On SE. point	25 51 30	77 10 45	Rev.	1.00	20	White & red.	160
Abaco Island. Cherokee (Cherokee) Sound.	On Duck cay	26 16 20	77 04 00	F. red.		6	Wood.	29
Abaco Island. Little Harbor	S. side of entrance	26 19 45	76 59 15	F. red.		6	Wood.	22
Abaco Island. Little Guana or Elbow Cay.	¾ mile inland	26 31 10	76 57 36	F.		15	Red & white.	123
Egg Island	On summit of island, NE. Providence channel.	25 30 30	76 53 00	F.		10	White.	72
Nassau Harbor. Hog Island	W. point	25 05 37	77 21 58	F. white or red.		10	White.	68
Nassau Harbor. Athol Island		25 04 58	77 17 27	F.		8	Cupola.	50
Andros Island	Fresh creek, south side of entrance.	24 43 45	77 46 45	F.		6	White.	27
Beacon Cay	On North rock, Ship channel, Great Bahama bank.	21 52 30	76 49 45	F. red & white.		8	White.	54

NAME.	LOCATION.	LATITUDE North	LONGITUDE West.	Description of Light.	Interval of Flash.	Distance visible in nautical miles.	Color of Tower or Vessel.	Height of Light above the Sea.
		° ′ ″	° ′ ″		m. s.			
ELEUTHERA ISLAND	At Tarpum bay	25 00 00	76 13 00	F.	.....	7	Spar.	35
LONG ISLAND	At Clarence Town	23 06 00	74 59 00	F.	.....	7	Spar.	.....
CROOKED ISLAND PASSAGE. Bird Rock		22 51 00	74 22 48	Rev.	1.30	17	Stone & blue.	120
CROOKED ISLAND PASSAGE. Castle Island	810 feet within SW. part.	22 06 40	74 20 37	F.	.....	17	White & red.	123
GREAT INAGUA ISLAND.	2 miles NW. of SW. point.	20 56 00	73 40 17	Rev.	1.00	17	White.	120
GREAT INAGUA ISLAND. Mathew Town.	In front of Custom House	20 57 30	73 41 10	F. red	.....	8	Steel.	40
COCKBURN HARBOR (South Caicos Island.)	On Government hill, 100 yards SE. from flagstaff.	21 29 33	71 31 00	F.	.....	9	Stone.	50
GRAND TURK	1,200 feet SW. ½ W. from N. extremity of island.	21 31 00	71 07 27	Rev.	0.30	15	White.	108
SALT CAY	Near the Lookout, on NW. point of Salt Cay.	21 20 35	71 11 54	F. White & red.	.....	W. 7 R. 2	Beacon	80
SAN SALVADOR OR WATLING ISLAND	Dixon hill, 2 miles from NE. point, 1 mile from the eastern shore.	24 06 15	74 26 00	Fl., 2 fl. ev. 30 sec.; fl. 2½ sec.; ecl. 4½ sec; fl. 2½ sec.; followed by an ecl. of 21 sec.	.....	19	White & bl'k.	165
LOBOS CAY	On cay	22 22 30	77 34 26	F.	.....	16	Bl'k & white.	146
DOUBLE-HEADED SHOT CAY.	On N. Elbow cay, NW. edge of Cay Sal bank.	23 56 30	80 27 51	F.	.....	15	White & red.	96

GREAT ANTILLES.

CUBA, NORTH COAST. San Antonio	On cape, 100 yds. in shore	21 51 30	84 57 38	Rev.	0.30	17	White.	128
Habana	Morro Castle, E. side of entrance.	23 09 21	82 21 30	Rev.	0.30	18	Stone.	144
Maya Point	East side of entrance to port Matanzas.	.....	.....	F.	.....	13	White.	62
Cay Piedras	Los Pinzones, N. side of entrance to Cardenas bay.	23 14 10	81 07 20	F. with red flash.	2.00	14	White.	75
Cay Diana	W. part	23 09 56	81 06 07	F.	.....	9	Iron column	46
Cruz del Padre Cay	On reef, ¾ mile NE. of cay, or ¾ mile from SE. extremity of surrounding reef.	23 17 07	80 53 20	F.	.....	10	White.	49
Bahia de Cadiz Cay	NE. part of cay	23 12 34	80 29 26	F. & Fl.	1.00	20	White.	175
Sagua la Grande	Ranchera point, NW. extremity of cay Hicacal.	22 48 58	80 04 23	F.	.....	09	Red pole.	55
Cay Frances	W. end of cay; entrance to port of Caybarien.	22 37 15	79 13 00	F.	.....	15	White & lead.	60
Cay Caiman Grande	.....	22 40 30	78 56 00	.....	.....	.....	.....	.....
Paredon Grande	N. part of cay	22 29 10	78 09 11	F. & Fl.	1.00	19	White & br'n.	156
Nuevitas del Principe	Maternillos point	21 40 02	77 08 04	F. & Fl.; durat'n of fl. 5 sec.	0.48	17	White.	174
Barlovento, or Pilots Point.	E. entrance	21 37 30	77 04 34	F.	.....	6	Mast.	35
Gibara	On point Peregina, E. side of entrance.	21 06 30	76 06 25	F.	.....	9	White.	40
Lucrecia	On point, 328 feet inshore	21 04 24	75 36 59	Fl. red.; durat'n of fl. 2 sec.	0.55	18	White.	132
Baracoa	S. side of entrance of port, about 153 yards ESE. from Barlovento point.	20 21 40	74 29 34	F.	.....	9	Iron column	50
Cape Maysi	On cape, E. point of island.	20 15 10	74 09 41	F.	.....	17	.....	128

233145

	NAME.	LOCATION	LATITUDE North.	LONGITUDE West.	Description of Light.	Interval of Flash.	Distance visible in nautical miles.	Color of Tower or Vessel.	Height of Light above the Sea.
			° ′ ″	° ′ ″		m. s.			
Cuba, South Coast.	Guantanamo	Angles of mole head	20 00 00	75 10 30	F. with red and green sec.		1		16
	Guantanamo	At entrance to port			F. red,		14	Gray.	94
	Santiago de Cuba	300 feet E. of the Morro castle.	19 57 31	75 52 12	F. & F.	.15	22	White.	228
	Cape Cruz	On cape, 118 feet inshore	19 49 40	77 43 48	F. with red fl.; fl. 3 sec. duration.	.75	17	Yellow & wh.	113
	Jagua, Xagua or Cienfuegos Harbor.	Colorado point, E. point of entrance.	22 01 00	80 29 18	F.		9	Pole.	42
	Cochinos Bay	Piedras cay, N. part	21 58 00	81 02 18	F.		9	Gray.	28
	Diego Perez	Light-vessel, N. of Jardines bank, and ¾ of a mile from shoal near Diego Perez cay.	22 02 20	81 26 20	F.		12	Black, white & red.	43
	Batabano	On mole	22 41 25	82 17 45	F.		4	Mast.	28
	Batabano	End of railroad company's dock.			F.		6	Red.	28
Jamaica Island.	Montego Bay	On the Parish Wharf			F. red.				
	Port Antonio	On Folly point	18 11 31	76 26 31	F. red.		13	Red & white.	54
	Morant Point		17 55 05	76 11 68	Rev.	1.00	15	White.	115
	Kingston	Plumb point, 200 feet northward of point.	17 55 32	76 46 45	F. with red sec.		14	White.	68
	Kingston	Fort Augusta	17 57 49	76 50 50	F. with red sec.		10	White.	87
	South Negril Point	West end of Jamaica	18 15 10	78 23 25	Int. white & red, vis. 57½ sec.; ecl. 2½ sector.		15	White.	100
Santo Domingo.	Porto Plata	On hill near signal station.	19 49 15	70 41 23	Fl.; duration of fl. 10 sec.	0.50	16	Brown and White.	137
	Santo Domingo City	Center of small bastion about 250 yds. westward of San José bastion.	18 28 09	69 53 09	Rev. wh. & red.	1.00		Iron.	111
	Port Macoris	On Islet at west side of entrance.			F.		10		
Haiti.	Arcadins	On center or largest of Arcadins islands, NW. point.	18 48 13	72 39 05	F.		9	White.	36
	Port au Prince	Lamentin point	18 33 46	72 25 28	Rev. red.	0.30	15	White.	97
	Port au Prince	Fort Islet	18 33 54	72 22 01	F. green.		11	White.	46
	Picolet Point	West side of entrance to Cape Haitien harbor.			Rev.	0.30	23	Iron.	131
Mona Island		On East Cape	18 02 43	67 50 30	Rev.	2.00	20	Black, Gray & Red.	235
Puerto Rico Island.	Port San Juan	On Morro point	18 28 56	66 07 28	F. & Fl., fl. 5 sec.	1.00	18	White & gray.	171
	Morillo de Arecibo (Punta Morillo).	East side of Arecibo road	18 29 30	66 41 30	F.		16	White.	120
	Point Bruquen		18 29 00	67 09 00	Fl. R. & W.	30	14	Red.	65
	Point Jiguero		18 22 00	67 16 00	F.		8		69
	Mayaguez	On wharf, W. of custom-house.	18 11 50	67 09 04	F. red.				12
	Morillos de Cabo Rojo.	SW. point of island	17 54 45	67 11 50	Rev.	1.00	18	Dark gray.	128
	SW. point of Muertos Island.		17 53 00	66 34 00	F. & Fl., 5 sec. duration.	3.00	18	White & light blue.	297
	Point Meseta	E. side of entrance to Port Guanica.	17 57 32	66 53 30	F.		8		118
	On the E. side of Cardones Island.	Port Ponce	17 57 30	66 40 30	F. red.		10	Lt. Blue & Wh.	46
	Tuna Point	SE. coast of Puerto Rico	18 01 30	65 51 00	Fl., 2 fl. every 2 m.		18	White.	123

NAME.	LOCATION.	LATITUDE North.	LONGITUDE West.	Description of Light.	Interval of Flash.	Distance visible in nautical miles.	Color of Tower or Vessel.	Height of Light above the Sea.
PUERTO RICO ISLAND — Figuras (Figuera) Point.	E. side of Arroyo bay.....	.....	.....	F.	.....	12	Gray, bl. & w.	47
PUERTO RICO ISLAND — Cabeza de San Juan.	NE. extremity of Puerto Rico.	18 23 10	65 37 26	F. with Fl. red.	3.00	18	Gray.	266
CULEBRITA ISLAND.....	On Summit, S. side of island.	18 18 43	65 18 45	F.	.....	21	Brick & White.	305
CRAB ISLAND — (Vieque or Bieque Is.) Mula Point.	N. side of island.....	18 09 30	65 26 48	F. red.	.....	8	Gray.	68
CRAB ISLAND — Port Ferro.....	S. side of island.....	18 06 20	65 25 40	F. Fl.; fl. 1-10 sec.	0.05	13½	Wh. & Black	65
VIRGIN AND CARIBEE ISLANDS.								
ST. THOMAS — St. Thomas Harbor	E. side of entrance on Muhlenfels point.	18 19 11	64 55 25	F.	.....	12	White.	115
ST. THOMAS — St. Thomas Harbor, King's Wharf.	N. side of harbor and end of jetty, 400 feet S. of King's wharf.	.....	.....	F. red & green.	.....	2	Posts.	.....
SANTA CRUZ OR ST CROIX — Frederichsted..	On center pier.....	17 43 20	64 53 12	2 F.	.....	2	Posts.	10
SANTA CRUZ OR ST CROIX — Christiansted...	On fort Louisa Augusta...	17 45 39	64 41 49	F.	.....	8	.....	52
SOMBRERO ISLAND.....	On SE. side of island and one-third its length from S. point.	18 35 37	63 28 13	Rev.	1.00	20	Red.	150
ST. MARTIN ISLAND. — Marigot Bay.	SSW. corner of old fort...	18 04 07	63 05 45	F. green.	.....	8	White.	66
ST. MARTIN ISLAND. — On site of old Fort Amsterdam.	Grand bay, W. side.....	18 00 47	63 04 15	F.	.....	10	.....	115
ST. EUSTATIUS ISLAND, (Oranjestad.)	On roof of the Port Office, 219 yards N. 63° W. from center of fort Oranje.	.....	.....	F.	.....	2	.....	.....
ST. CHRISTOPHER ISLAND.	Basse Terre, on dome of new Treasury Building.	17 18 00	62 43 10	F. red.	.....	.....	.....	.....
MONSTERRAT ISLAND ...	On beach at Plymouth...	16 42 12	62 13 17	F.	.....	.....	Mast.	.....
ANTIGUA ISLAND. — Sandy Island.....	.....	17 06 54	61 55 11	F.	.....	13	Black & red.	56
ANTIGUA ISLAND. — Fort James.....	North side of entrance to St. Johns harbor.....	17 06 40	61 51 40	F. red.	.....	5	White.	48
ANTIGUA ISLAND. — Pillar Rock Point	South side of entrance to St. Johns harbor.....	17 06 30	61 52 35	F. green.	.....	10	White.	106
GUADELOUPE ISLAND. — Petite Terre.....	On islet Terre d'en Bas, 600 feet from eastern extremity.	16 10 17	61 06 45	F.	.....	15	.....	108
GUADELOUPE ISLAND. — Pointe a Pitre.....	Gozier islet.....	16 11 57	61 29 40	F.	.....	12	White.	79
GUADELOUPE ISLAND. — Pointe a Pitre.....	Fouillole point, S. coast	16 13 36	61 32 10	F. red.	.....	6	Red.	77
GUADELOUPE ISLAND. — Pointe a Pitre.....	Monroux islet.....	16 13 14	61 32 05	F.	.....	7	Red.	33
GUADELOUPE ISLAND. — Sainte Marie.....	On piles, 995 yards N. 43° E. from the site of RED ROOF.	.....	.....	F.	.....	.....	Piles.	.....
GUADELOUPE ISLAND. — Sainte Marie.....	Inner end of abandoned wharf, 158 yards east of the harbor pier.	.....	.....	F.	.....	.....	Mast.	.....
GUADELOUPE ISLAND. — Port Louis	On the beach, 1,410 feet N. 61° W. from the bell tower.	16 25 09	61 32 15	F.	.....	4 to 5	Mast.	39
GUADELOUPE ISLAND. — Port du Moule.....	Near signal mast.....	16 19 59	61 20 47	F.	.....	7	Mast.	46
GUADELOUPE ISLAND. — Basse Terre.....	On quay.....	15 59 50	61 44 09	F. red.	.....	7	Mast.	46
GUADELOUPE ISLAND. — Anse a la Barque...	Left side of entrance.....	.....	.....	F. red.	.....	9	.....	69
GUADELOUPE ISLAND. — Anse a la Barque...	Foot of the cove.....	.....	.....	F.	.....	.....	Mast.	20
MARIE - GALANTE ISLAND.	55 yards east of the pavilion of the fort Grand Bourg.	15 52 59	61 19 15	F.	.....	7	Mast.	46
DOMINICA ISLAND, Roseau.	Extremity of landing pier.	15 17 27	61 23 57	F. red.	.....	.....	.....	.....

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			° ′ ″	° ′ ″		m. s.			
St. Lucia Island Martinique Island.	Fort de France	Point des Negres, in the fort.	14 35 49	61 05 58	F.	.....	7 to 8	Masts.	54
	Fort de France	Fort St. Louis in SW. part of fortress.	14 35 44	61 04 30	F. red w. 2 whitesec.	.....	9	Gray.	84
	Fort de France	Boat landings	.....	.....	2 F., red & white.	.....	.....	.....	.....
	St. Pierre Bay	St. Marthe point, on battery at summit.	14 43 54	61 11 12	F. white & green. (Upper light).	.....	W. 5 G ½	Gray.	141 125
	St. Pierre Bay	Bertin place, S. extremity	14 44 26	61 11 04	F. red.	.....	4	Bell. & White.	57
	Caracoli Mountain (La Trinite)	Caravelle peninsula, ⅛ mile inland.	14 46 13	60 53 20	F.	.....	12	Gray.	410
	Port Castries	Summit of Vigie, N. side of entrance to harbor.	14 01 35	61 00 35	F.	.....	12	Black & White.	300
	Port Castries	Western wharf of Market place, 320 feet S. 87° W. from the Government flagstaff.	.....	.....	F. red.	.....	.....	Red & White.	.....
	Port Castries	On hill, 2,500 feet S. 59° 30′ E. from front light.	.....	.....	F. green.	.....	.....	Red & White.	.....
	Tapion Rock	S. side of entrance to Port Castries.	.....	.....	F. red.	.....	2	.....	80
	St. Vincent Island	East end of Fort Charlotte, Kingstown.	13 09 19	61 14 34	F.	.....	15	Flagstaff.	640
Barbados Island.	Ragged Point	900 feet within the extremity of the cliff.	13 09 40	59 26 04	Rev.	2.00	21	White.	213
	S. Point	600 feet inshore	13 02 45	59 31 50	Rev. red; ecl. 24 sec.	1.00	18	Red & White.	145
	Carlisle Bay	Needham point	13 04 34	59 36 42	F. with red sec.	.....	7	White.	60
	Bridgetown	Adjutant General's wharf.	.....	.....	F. red	.....	1	.....	.....
	Grenadines	At Hillsborough, west side of Carriacon Is.	12 28 40	61 27 20	F.	.....	6	.....	200
	Grenada Island	Extremity of N. bastion of fort George, St. George harbor.	12 03 02	61 45 12	F.	.....	10	Brick.	192
		MEXICO AND CENTRAL AMERICA.							
	Tampico	N. point of river entrance.	22 15 50	97 49 00	Fl., 3 fl. in quick succession.	30	18	Iron.	140
	Tuxpam (Tuspan)	Left side of mouth of river.	20 59 40	97 17 00	F.	.....	13	White.	56
	Lobos Island	WSW. side of the island.	21 28 12	97 13 00	Fl.	30	13	White.	56
Veracruz.	Convent of San Francisco.	.....	19 12 06	96 08 19	F. & Fl.	1.00	15	Blue & white.	102
	Town wharf gate	.....	19 12 00	96 08 20	F. red.	.....	7	.....	.....
	Blanquilla de Veracruz.	On northwestern part of the reef.	19 13 40	96 06 05	Fl. red, 2 lightning flashes in quick succession.		11	White & red.	33
	Sacrificios Island	.....	19 09 55	96 05 30	F. wh. & red with inter. wh. sector.	.....	8	Red.	29
	Santiaguillo (Santa Guilla) Island.	Center of island	19 08 40	95 48 50	Fl., every 10 sec. 2 fl. in quick succession, followed by ecl. of 7½ sec.; 1 fl. red in same tower 10 ft. bel. main light.	.....	15	Red.	69 59

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ENMEDIO (Medio) ISLET	Anton Lizardo reefs	19 06 10	95 56 28	F. with 2 red secs.	.....	12	White.	46
BLANCA (Blanquilla) de ANTON LIZARDO	On the south side of the reef	19 05 15	96 00 05	Int.; 3 eclipses in succession. The dur't'n of light between the groups of eclipses is 3 times as lo'g as the per'ds occupied by the gr'ps.	.....	11	White.	33
RIZO DE ANTON LIZARDO	On the southeast end of the reef	19 03 20	95 55 15	Fl.;3 lig't-ning fl'h's in quick succ'sion.	.....	11	Red.	33
ALVARADO	About 1 mile WNW. of Papaloapam bar, north side of entrance to the port.	18 49 00	95 46 30	F.	.....	11	Black.	167
COATZACOALCOS RIVER	Old lookout tower, W. side of entrance, ½ mile from beach.	18 08 15	94 24 28	F.	.....	12	.....	126
COATZACOALCOS RIVER	393 yards N. 2° 42′ E. from main light.	.....	.....	F.	.....	11	White.	80
FRONTERA DE TABASCO	North side of river entrance.	18 39 30	92 42 00	F. & Fl.	1.00	F 11 Fl. 13	Green.	77
LAGUNA DE TERMINOS	Indian village	18 33 19	91 52 34	Rev.	30	14	White.	100
CHAMPOTON RIVER	On left bank	19 21 40	90 43 08	F.	.....	10	.....	52
MORROS DE SEYBAPLAYA.	.....	19 41 15	90 41 54	Fl. gr'ps of 3 fls.	13	19	White	164
CAMPECHE	On San Jose church tower.	19 50 20	90 32 20	F.	.....	14	.....	95
ARCAS CAYS	Center of East Cay	20 12 00	91 57 15	Fl; every 10 sec. 2 fl., e'ch $\frac{1}{10}$ sec.; ecls. $2\frac{1}{10}$ and $7\frac{1}{10}$ sec.	.....	15	Red.	72
CELESTUN	.....	20 51 00	90 24 20	2 F.	.....	10	Red.	38 28
SISAL	On castle	21 10 06	90 02 37	F.	.....	12to 13	White.	60
PROGRESO	Center of city	21 17 00	89 39 30	Fl.	1.00	17	Gray & white.	115
ALACRAN REEF	.....	22 23 38	89 41 48	F. & Fl.; gr'p of 3 fl. follow. by a single fl.	.....	13	Red & white.	56
CAPE CATOCHE	Northeast coast of Yucatan	21 35 50	87 04 10	Fl., 4 fl. in quick succession.	.10	12	Red.	42
CONTOY ISLAND	On reef at north end of island, 383 yards from the north point of the island	21 33 00	86 48 00	Fl.	.05	12	Red.	42
CHINCHORRO REEF	On the northern of the two islets which form the north cays	18 45 40	87 18 50	Fl.	.30	12	Red & white.	43
COZUMEL ISLAND. Punta Moles	On north point of the island	20 35 50	86 43 55	F. Fl.; 3 white fl.	.....	13	Red.	56
COZUMEL ISLAND. Punta Celarain	South point	20 16 20	86 59 04	F. Fl.	.....	14	Red & white.	56

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		° ′ ″	° ′ ″		m. s.			
TURNEFFE CAYS.	Mauger cay, 1¼ miles within N. end of reef.	17 36 15	87 46 30	3 F. in a triangle	.....	13	White.	58 49
BOKEL CAY	On cay, south extreme of Turneffe cays.	17 08 50	87 55 50	2 F., N. 39° E. S., 39° W., 50 yds. apart.	.....	13	Masts.	68
BELIZE: English Cay	S. side of channel	17 19 30	88 03 20	F.	.....	7	White.	45
BELIZE: Lunatic Asylum	Former site of fort George	17 29 20	88 11 20	F.	.....	7	Rd., wh. & black	43
MULLINS RIVER		17 07 05	88 18 10	F.	.....	13	White.	56
STANN CREEK		16 57 40	88 14 40	F.	.....	13	White.	56
ALLPINES	North end of Zapotillos lagoon.	16 46 35	88 18 10	F.	.....	13	White.	56
BUGLE CAYS (southwest cay).	Eastern side of narrows, main channel leading to Belize from the southward.	16 29 30	88 20 00	F.	.....	10	Red, white & black.	53
MONKEY RIVER	North side of entrance	16 21 55	88 29 25	F.	.....	8	White.	52
PUNTA GORDA		16 05 10	88 49 20	F.	.....	13	White.	56
LIVINGSTONE	River Dulce	.....	.....	F.	.....	.....	Staff.	.....
PUERTO BARRIOS	St. Thomas bight. On end of wharf.	.....	.....	F.	.....	.....	Staff.	.....
PORT CORTES	On Caballos point, about 50 yards back from the beach	15 48 50	87 57 40	F. with a red sector	.....	15	White.	110
HALFMOON CAY	SE. point	17 12 15	87 32 30	F.	.....	16	White.	76
NORTHERN TWO CAYS.	Sandbore cay, northern end of Lighthouse reef.	17 28 00	87 27 30	Fl.	30	13	White & Red	70
BONACCA ISLAND	On cay XII	16 26 30	85 52 40	F.	.....	6	Mast.	.....
COXEN HOLE	Coxen road, Roaton Island, on reef, SW. of Coxen cay.	16 18 00	86 34 30	F.	.....	4	White & black	.....
UTILLA ISLAND	Off East Reef	16 05 00	86 54 00	F.	.....	4	Wood.	.....
CAPE GRACIAS A DIOS		15 00 00	83 10 00	F.	.....	12	.....	50
BLUEFIELDS BLUFF		.....	.....	.....	.....	.....	.....	.....
CORN ISLAND		.....	.....	.....	.....	.....	.....	.....
GREYTOWN	On sand hill, 385 yards south of outer (north) end of the breakwater at entrance to harbor.	10 56 15	83 42 15	F.	.....	14	Wood.	70
PORT LIMON	Grape cay, highest point.	10 00 05	83 02 00	F.	.....	12	.....	60
COLOMBIA.								
COLON (Aspinwall)	NW. part of Manzanillo island.	9 22 09	79 54 45	F.	.....	10	White.	60
TORO POINT	West side of entrance to Limon bay, Colon approach.	9 22 31	79 57 05	Fl. flash 5 sec.	0.30	16	White & red.	108
ISLA GRANDE	Off Manzanillo point, about 10 miles NE. from Portobelo.	9 39 00	79 35 00	Fl. wh. & red alt.	0.05	24	White.	305
CARTAGENA: Convent of La Mercedes.		10 25 50	75 32 50	Rev.	0.15	15	White.	106
CARTAGENA: Fort San Fernando	E. angle	.....	.....	F.	.....	12	.....	60
GALERA ZAMBA	On SE. side of Galera de Zamba bay.	10 41 00	75 20 00	Fl.	1.00	20	.....	.....
PORT SAVANILLA	About the middle of Cupino beach.	11 00 15	74 57 55	F. & Fl. fl. of 3 sec. duration.	2.00	15	White.	98
PORTO BELILLO	Point Belillo	.....	.....	F.	.....	15	Red.	60
SANTA MARTA	Summit of Morro grande	11 15 28	74 14 33	F.	.....	12	.....	328
LA HACHA	On church tower	11 33 30	72 54 50	F.	.....	15	White.	90
VENEZUELA, Etc.								
ORANGESTADT HARBOR, PUERTO CABALLOS.	Oruba island, on fort	12 31 05	70 02 34	F.	.....	6	White. R.&blu.	61
PUNTA DEL CERRITO COLORADO.	E. point of Oruba Island.	12 24 35	69 52 00	F.	.....	9	Iron.	120

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			° ′ ″	° ′ ″		m. s.			
	MARYCABO, or MARACAYBO.	Zapara Island	10 57 30	71 37 00	F.	... ...	6	Stone.	30
	CUMAREBO BAY	5 miles S. 62° W. from Manzanillo point.	11 30 00	69 20 30	F.	.....	6	.....	.....
	VELA DE CORO	.....	11 27 56	69 34 20	F.	.....	.....	.....	.....
	GREAT CURACAO ISLAND.	Santa Anna Harbor, S. angle of water battery of fort Amsterdam.	12 06 20	68 56 27	F.	.....	10	Green.	42
	LITTLE CURACOA	Near center of island	11 59 30	68 39 19	F. & Fl. fix. 15 sec; ecl. 3 sec.; fix. 15 sec; ecl. 10 sec; flash 4 sec; ecl. 11 sec; total 58 seconds.	.....	F. 7 Fl. 11	White.	75
BUEN AYRE.	Point Lacre	S. point of island	12 02 06	68 14 10	F.	.....	10	White & red.	72
BUEN AYRE.	Kralendijk (El Puerto).	W. side of island, opposite Little Buen Ayre.	12 09 31	68 15 20	F. red.	.....	3	Yellow.	29
	PUERTO CABELLO	Brava point	10 29 53	68 00 55	F.	.....	.....	Pole.	.....
LA GUAIRA.	On signal fort La Vigia.	.....	10 37 41	66 56 38	F. elec.	.....	24	.....	300
LA GUAIRA.	Extremity of breakwater.	.....	.....	.....	F. red.	.....	2	Iron.	46
LA GUAIRA.	Bastion of Santa Barbara fort.	.....	.....	.....	F., elec.	.....	.....	.....	.....
	LOS ROQUES	Second hill from E. end of El Roque.	11 57 00	66 40 52	Rev.	1.00	15	Iron col'mns	208
	CUMANA	On top of west front of new custom house.	10 27 20	64 11 33	F., white red & gr'n	.....	3	Wood.	44
	MARGARITA ISLAND	Palmar (Pueblo de la Mar) N. side of La Mar bay.	10 56 50	63 52 30	F.	.....	12	.....	56
TRINIDAD.	Port of Spain	On Kings wharf	10 38 37	61 30 38	F. red, el'c	.....	13	White.	50
TRINIDAD.	Port of Spain	On New St. Vincent jetty	10 38 40	61 30 55	Int. every 15 sec., light 10 sec., ecl. 5 sec.	.....	10	Iron.	24
TRINIDAD.	Extremity of Galera Point	NE. extreme of Trinidad island.	10 50 00	60 54 10	Fl.; flash 2 sec., ecl. 4 sec., flash 2 sec., ecl. 37 sec.	45	17	White.	114
TRINIDAD.	Chacachacare (Bocas de Dragos).	On the summit above the northern point of the island.	10 41 40	61 45 10	Fl., fl. 1¾ sec., ecl. 13¼ sec.	15	20	White.	865
TRINIDAD.	Brighton (La Brea)	On outer end of the jetty at point Boyer	10 14 45	61 38 30	F.	.....	7	Red.	50
TRINIDAD.	Icacos Point	SW. extremity	10 03 29	61 55 41	F.	.....	4	Mast.	50
	TOBAGO	Scarborough, Bacolet or Red Point.	11 10 08	60 42 38	F.	.....	12	Red & white.	115
	PONTON BARIMA	Boca Grande entrance of the Orinoco river, northwestward of point Barima, in 27 feet of water.	8 40 30	60 23 00	F.	.....	.....	Light Vessel.	.....
	CANGREJO ISLAND	E. end	.....	.....	.....	.....	.....	.....	.....
	GUIANA.								
DEMERARA.	Demerara	Light-vessel in 19 feet; Georgetown (Demerara), lighthouse S. 37° W. distant 8¾ miles.	6 56 15	58 06 15	F.	.....	12	Red.	30
DEMERARA.	Georgetown	E. side of entrance	6 49 20	58 11 30	Rev., F. R. in same tower.	1.00	16 3	Red & white.	103
DEMERARA.	On jetty called East Best Groin.	W. side of entrance	.....	.....	F. green.	.....	2	.....	.....

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BERRICE	Light-vessel moored in 22 feet, 9 miles, N. 35° E. from point St. Andrew.	6 29 50	57 23 50	F.	.....	10	White & red.	30
NICKERIE RIVER	At mouth of river	5 58 30	57 00 30	F.	.....	.....	Post.	.....
SURINAME	Light-vessel in 14 feet, about 5 miles N. 34° W. from Braams point.	6 02 20	55 13 15	F.	.....	8	Red, bl, & wh.	25
MARONI R. — W. side of entrance on Galibi point.		5 44 54	54 00 30	F.	.....	12	White.	51
MARONI R. — E. side of entrance. Hattes (Francaise) point.		5 44 54	53 57 36	F.	.....	10	White.	75
MANA RIVER	On Isere point, north side of entrance.	.....	.....	F.	.....	8	Mast.	.....
SINNAMARI RIVER	West side near entrance.	5 21 00	52 54 00	F.	.....	9	White.	43
CAYENNE. — Salut Islands	On W. end of Royale island, on top of hospital.	5 16 50	52 34 53	F.	.....	13	.....	197
CAYENNE. — Enfant Perdu	On a rock, 6 miles N. 5° W. of the port of Cayenne.	5 02 40	52 21 11	F.	.....	7	Iron.	61
CAYENNE. — On the N. glacis, 66 yds. S. by W. from Ceperou Fort.		4 56 20	52 20 26	F.	.....	12	Wood	130
CAYENNE. — End of jetty at Cayenne.		4 56 04	52 20 10	F. red.	.....	.....	Wood	19
	BRAZIL.							
BALIQUE ISLAND	West side of entrance to western mouth of the river Amazon	0 54 30 N.	49 55 45	Rev.	.....	13	White.	60
PARA RIVER. — Soure	North side of entrance to the Igarapé Grande	0 41 50 S.	48 31 30	F. red.	.....	6	.....	25
PARA RIVER. — Joannes Point	Western shore	0 51 00 S.	48 31 00	F.	.....	10	.....	40
PARA RIVER. — Braganca Bank Lightvessel.		0 23 00	47 55 30	F.	.....	8	Red.	33
PARA RIVER. — Off point Taipu		0 39 00	48 09 00	F. red.	.....	7	.....	.....
PARA RIVER. — Colares Shoal	On rock	0 53 00	48 17 00	F.	.....	12	White.	39
PARA RIVER. — Chapeo Virado	On the SW. extreme of the point	1 07 48	48 28 12	F. red.	.....	13	White.	36
PARA RIVER. — Fort da Bara	On fort	1 22 30	48 29 15	F.	.....	7	Iron col	.....
PARA RIVER. — Marianno	On Guajara island	1 32 00	48 29 54	F.	.....	7	Iron col	29
PARA RIVER. — Cotijuba	On island	1 15 49	48 33 25	F.	.....	7	Iron col	31
PARA RIVER. — At mouth of the Arozal River.		.....	.....	F.	.....	7	Iron col	31
PARA RIVER. — Capiru	On island	1 33 55	48 50 35	F.	.....	7	Iron col	29
PARA RIVER. — Goiabal	On S.W. point of Mandiby island.	1 37 40	49 10 00	F.	.....	8	Iron col. red.	52
PARA RIVER. — Camelao	North of that island, near mouth of Mocajatuba river.	1 49 30	50 01 00	F.	.....	7	Iron column	29
PARA RIVER. — Jacunda Coroa Island.	Mouth of the Breves river.	1 47 30	50 18 00	F.	.....	7	Iron column	29
POINT ATALAIA (Salinas)	On point	0 35 03	47 20 54	F. & Fl.	2.00	17	Stone.	101
SAN JOAO ISLAND		1 17 40	44 53 40	F.	.....	14	Red.	85
MARANHAO (MARANHAM). — Itacolumy Point		2 10 11	44 25 58	F. & Fl.	2.00	18	Stone.	157
MARANHAO (MARANHAM). — Alcantara Point		2 24 30	44 23 30	F.	.....	9	.....	72
MARANHAO (MARANHAM). — San Luis	San Marcos fort	2 29 20	44 17 00	F.	.....	15	White.	119
MARANHAO (MARANHAM). — Santa Antonio da Barra.	Santa Antonio fort (Areia point).	2 30 20	44 18 30	F. red with whitesec	.....	W. 9 R. 4	Iron column	30
SANTA ANNA	Eastern part of island	2 16 22	43 36 26	Rev. red & wh., 2 wh. fl. & 1 red fl. of equ'l intensity.	0.30	20	White.	197
PEDRA DO SAL	On point	2 48 55	41 44 40	F.	.....	10	Iron.	59
CAMOCIM RIVER ENTRANCE.	On Trapia point	2 51 30	40 52 50	F. & Fl.	30	12	White.	45

NAME.	LOCATION.	LATITUDE North.	LONGITUDE West.	Description of Light.	Interval of Flash.	Distance visible in nautical miles.	Color of Tower or Vessel.	Height of Light above the Sea.
		° ′ ″	° ′ ″		m. s.			
CEARA. Mucuripe Point		3 42 05	38 28 25	Rev.	1.00	12	Iron.	108
CEARA. Aracaty	At the mouth of the river, N. side of entrance.	4 24 35	37 44 46	F.	.....	10	Stone.	.....
RIO MOSSORO	East side of entrance on point Upanema.	4 56 24	37 04 53	F., varied by wh. fl.	15	13	Iron col	46
MACAO (MACAU)	In the Alagamar	5 07 00	36 34 00	F., varied by wh. fl.	30	12	White.	43
MEL POINT	Between the Mossoro and Conchas rivers.	4 58 30	36 52 00	F. & Fl., part. ecl.	80	.....	White.	327
AS ROCAS	On reef NW. part of the atoll.	3 51 30	33 49 24	F.	.....	9	Mast.	59
RIO GRANDE DO NOTRE.	Fortress of Reis Magos	5 45 05	35 11 55	F.	.....	10	Red.	46
RIO PARAHYBA DO NOTRE.	On Pedra Secco, off bar at Cabedello.	6 56 30	34 49 30	Rev.	1.00	12	White.	52
OLINDA POINT	Old fort of Monte Negro	8 00 50	34 50 36	F. Fl.; fl. every 2 min.	2.00	12	Red.	62
PERNAMBUCO	On reef 50 yards from Picao fort	8 03 22	34 51 57	Rev., wh. & red; 2 wh. fl. & 1 red fl. in success'n	30	20	Stone.	79
CAPE ST. AGOSTINHO	On cape	8 21 00	34 56 05	F.	.....	25	White.	345
MACEIO	One mile from anchorage, W. part of mountain.	9 39 30	35 44 54	F. & Fl., fix. 70 sec; ecl. 16 sec; fl. 12 sec.; ecl. 22 sec;	.....	20	Stone.	197
SAMOUCO (Samoco)	S. point of entrance to river Sao Francisco do Norte.	10 30 30	36 21 51	F.	.....	10	White.	59
ARACAJU (Cotinguiba bar).	S. side of river entrance	10 58 20	37 04 00	F. & Fl., fix. 30 sec; then 5 fl., each of 2 secs. dur'n ecl. 3 sec.	.....	17	White.	125
REAL RIVER	North side of entrance	11 27 40	37 24 00	F.	.....	10	White.	70
ITAPOAN (Itapuan)	Piraboca rock, 600 feet from the shore.	12 57 10	38 21 15	F.	.....	12	Red.	68
BAHIA OR SAN SALVADOR. Ft. San Antonio		13 00 37	38 32 06	Fl., wh. & red, 2 wh. fl. 1 red in success'n	.10	17	Stone.	122
BAHIA OR SAN SALVADOR. Fort Santa Maria		13 00 24	38 32 00	F. green & red.	.....	5	Red.	52
BAHIA OR SAN SALVADOR. Fort do Mar (San Marcello)		12 58 16	38 30 68	F. red.	.....	4	Stone.	46
BAHIA OR SAN SALVADOR. Montserrat Point.		.....	.....	F.	.....	3	.....	18
NOSSA SENHORA DO GUADALUPE.	South point of Frade island.	12 48 50	38 38 25	F. red.	.....	9	Red.	100
MORRO DE SANTO PAULO.	On Morro	13 22 37	38 54 38	Rev.: fl. 15 sec.	.45	25	White.	272
BELMONTE	At entrance of river Jequitinhonha.	15 51 00	38 53 00	F.	.....	10	White.	59
ABROLHOS	Santa Barbara island, highest point.	17 57 31	38 41 46	Fl.	.30	23	Iron.	197
RIO DOCE	On eastern side of entrance.	19 37 00	39 45 15	Fl., red & wh. alter.	.30	16	White.	.....
ESPIRITO SANTO BAY	On Santa Luzia Point, S side of entrance to port Victoria.	20 19 23	10 16 26	F.	.....	12	Iron.	75
FRANCEZA ISLAND (Ilha Franceza).	Highest part of island	20 54 40	10 42 33	F.	.....	14	Stone.	156
S. JOAO DA BARRA	South side of Paraniba river entrance.	21 38 40	41 02 41	F.	.....	12	White.	41
CAPE ST THOME	On cape	22 02 00	40 59 00	Rev.	1.00	19	R &wh.	161
CAPE FRIO	Focinho do Cabo Point	23 00 42	42 00 00	Fl. ecl. total.	.20	30	White.	474

NAME.	LOCATION.	LATITUDE North.	LONGITUDE West.	Description of Light.	Interval of Flash.	Distance visible in nautical miles.	Color of Tower or Vessel.	Height of Light above the Sea.
		° ′ ″	° ′ ″		m. s.			
Raza (Rasa)	On island	23 08 40	43 08 45	Fl. red & wh., 2 wh. fl. & 1 red. fl. of 4 sec. each.	.11	24	White.	315
Rio de Janeiro — Fort Santa Cruz	E. entrance	22 56 36	43 08 24	F.	.....	7	.....	49
Rio de Janeiro — Fort Villegagnon	Eastern end	22 54 46	43 09 24	F. red.	.....	8	Iron.	59
Rio de Janeiro — Calabouco Point	.....	.....	.....	F. R., with green sec.	.....	2	Iron.	16
Sao Sebastiao Island	On Boi Point	23 58 30	45 15 20	Fl.	.10	20	White.	243
Santos	Moela island	24 08 06	46 15 57	Fl., white and red.	30	24	White.	339
Cananeia	Bom Abrigo island	25 06 40	47 51 50	Fl. red & wh.; 2 wh. fl., follow. by 1 red fl.	15	14	White.	505
Paranagua Bay — On Fort	East side Isle do Mel	25 30 55	48 19 31	F. red.	.....	6	Iron.	52
Paranagua Bay — On Summit of Moro das Conchas (Conxas)	On NE. part of Isle do Mel.	25 32 38	48 18 20	F.	.....	18	White.	197
Joao Dias	On cape, S. side of entrance to San Francisco do Sul river.	26 10 15	48 33 10	F.	.....	12	White.	311
Arvoredo Island	SE. point	27 18 00	48 22 20	F. & Fl. red & wh., alt. fl'sh's	2.00	23	White, red & green.	295
Anhato-mirim	Fort Santa Cruz, on the islet.	27 25 30	48 34 25	F.	.....	12	White.	128
Santa Catharina Island	Naufragados point, S. end of island.	27 50 27	48 35 16	Rev., fl. 6 seconds.	0.45	16	Stone.	140
Batuba (Imbituba)	On Batuba (Imbituba point).	28 16 45	48 40 21	F.	.....	10	Iron.	69
Cape Santa Martha Grande	On cape	28 38 00	48 49 45	F. & Fl., with F. & Fl. red sector; 2 fl. in q'ck succes'n.	0.30	22	White.	250
Mostardas	On point	31 16 30	51 01 45	Rev. red & white fl. alt.	0.30	17	White.	115
Rio Grande do Sul	N. point of entrance 1 1-10 miles from extremity of point.	32 06 40	52 08 11	F. & Fl. ev. min.; fix'd 30 sec., then 1 fl. & a short ecl. ev. 6 sec. in next 30 sec.	1.00	16	Red.	104
Patos Lake — Diamante Shoal	In 6 feet of water about 2 miles northwestward from point Mendanha.	.....	.....	Fl.	0.15	7	Beacon	.....
Patos Lake — Pelotas bar	At entrance between the first and second buoys.	.....	.....	Fl	0.15	10	.....	23
Patos Lake — Estreito	On plateau of rocks, 1¼ miles from Estreito point.	31 48 30	51 52 05	F.	.....	8	White.	41
Patos Lake — Bojuru	On point	31 26 00	51 31 45	F.	.....	12	White.	69
Patos Lake — Cape Marca	On cape	31 18 00	51 16 41	F.	.....	15	White.	52
Patos Lake — Christovao Pereira	On point	31 04 00	51 14 21	F.	....	15	White.	102
Patos Lake — Itapoan	On point, at eastern side of entrance to Guahyba river.	30 22 24	51 08 41	F.	.....	12	White.	55

	NAME.	LOCATION.	LATITUDE North.	LONGITUDE West.	Description of Light.	Interval of Flash.	Distance visible in nautical miles.	Color of Tower or vessel.	Height of Light above the Sea.
			° ′ ″	° ′ ″		m. s.			
	URUGUAY AND ARGENTINA.								
Rio de la Plata.	San Jose Ignacio Point.	On point	34 50 51	54 38 05	F. Int. bri'ht	.....	15	.....	103
	Maldonada Bay	E. point	34 58 15	54 57 10	1½ min. ecl. 25 sec.	.....	18	.....	152
	Flores	On island	34 56 55	55 55 04	Rev. ecl. 15 sec.	1.00	12	White.	104
	Punta Brava	On point, 200 yards N. of Punta Brava reef.	34 56 00	56 10 15	F.	.....	10	White.	69
	English Bank Light-vessel.	N. part of bank, in 7 fathoms.	35 06 30	55 52 45	F.	.....	12	Red.	.....
	Montevideo	W. side of harbor, on mount (El Cerro).	34 53 03	56 15 09	F. & Fl., 5 sec. dura., prece'd & foll'd by a short ecl.	1.30	25	Brown.	486
	Montevideo	Cathedral, S. tower	34 54 33	56 12 15	F.	.....	.....	.....	147
	Panela Shoal Light-vessel.	600 feet N. 22° W. of shoal.	34 54 36	56 27 45	F.	.....	5	Hulk.	17
	Point Indio Light-vessel.	N. 44° E. 9 miles from Indio point, in 3½ fathoms.	35 09 30	57 06 30	Int., fix'd 15 sec., ecl. 6 sec.	.....	14	Red & black.	43
	Point Indio	On point	35 15 45	57 10 45	F.	.....	10	.....	.....
	Chico Bank Light-vessel.	Northward of Chico bank, near the edge of the bank.	34 46 15	57 29 50	F.	.....	10	Red.	20
	La Plata	E. and W. piers	34 48 00	57 54 00	2 F. red.	.....	4 to 5	.....	.....
	Sauce Port	On Mole No. 1	.....	.....	F., F. red on same mast.	.....	14 8	Mast.	.....
	Colonia	SW. angle of plaza	34 28 20	57 51 56	Rev.	3.00	10	White.	110
	Farallon Island	On island	34 29 00	57 56 55	F.	.....	13	White.	84
	Riachuelo	On mole heads	.....	.....	2F.R.&W.	.....	5	.....	43
	Buenos Aires	Custom-house tower	34 36 30	58 22 14	.....	.....	.....	.....	.....
	Martin Garcia	On island	34 10 50	58 15 40	F.	.....	12	Stone.	130
	Punta Piedras Light-vessel.	14½ miles S. 81° E. from Piedras point, moored in 26 feet of water.	35 29 15	56 49 30	F.	.....	12	Red, black & white.	42
	Rasa Point	Cape San Antonio	36 18 24	56 44 15	Rev., fl. 12 sec., ecl. 18 sec.	0.30	20	Lead.	190
	Point Medanos	Near the point	36 53 00	56 38 54	F.	.....	21	Red & white.	195
	Punta Mocotes	On point, 273 yards from the beach.	38 05 40	57 31 17	Rev., fl. 32 sec., p'rt'l ecl. 28 sec.	1.00	22	Stone.	180
	Bahia Blanca Light-vessel.	12 miles S. 5° 30′ E. from Monte Hermoso.	39 10 45	61 39 00	Int., visible 42 s'c., & ecl. 18 sec.	1.00	14	Red & black.	.....
	South Barranca	East point of S. Barranca, west side of Rio Negro entrance.	41 03 20	62 48 00	F.	.....	14	White.	142
	Port Gallegos	.....	.....	.....	F. red.	.....	.....	Staff.	.....
	Falkland Island	Cape Pembroke	51 40 40	57 41 48	F.	.....	14	White.	110
	Staten Island	W. point of entrance to St. John harbor.	54 43 24	63 47 00	F.	.....	14	.....	200

RIGGS & BROTHER

Chronometer and . .
Nautical Warehouse

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Established 83 Years . .

HAVE CONSTANTLY ON HAND

New and Second-hand Chronometers, by Celebrated Makers, at Moderate Prices . . .

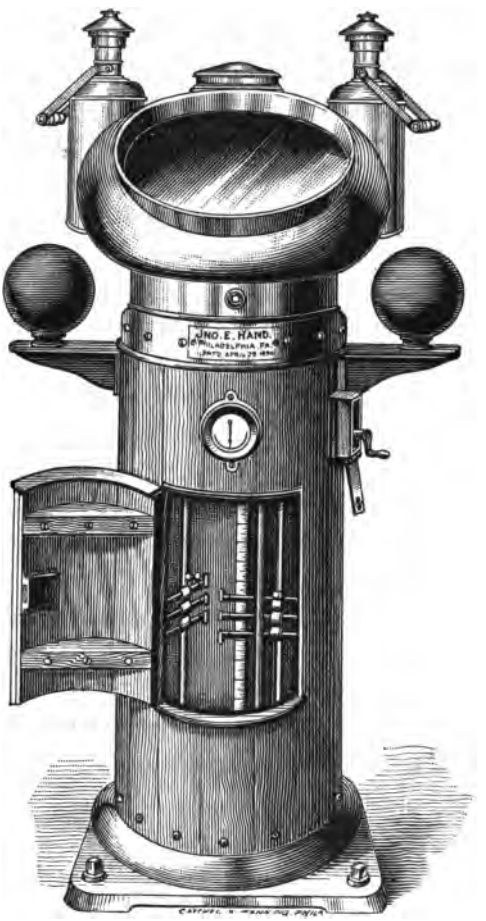
Chronometers Readjusted, Cleaned and Repaired.
All kinds of Nautical Instruments Repaired. . .

CHRONOMETERS TO HIRE

HAND'S PATENT

Compensating Binnacle

ADAPTED FOR EITHER
STANDARD OR PILOT HOUSE



PRICE
Complete

$200.00

RIGGS & BROTHER

. . . **SOLE AGENTS** . . .

SEE NEXT PAGE

WE call the attention of Masters and Owners desiring a first-class Binnacle, to the merits of our improved system of adjustment, as used in this Binnacle, and to the following advantages, which are found only in it. The magnets cannot get out of place, or rust, as they are enclosed in sealed brass casings, and securely locked in position. The movement of magnets, when adjusting, is controlled from the outside of Binnacle, by means of a small crank key; this enables the adjuster to watch the compass while he is altering the position of magnets, and to move them the exact amount desired; thus avoiding the annoyance and time lost in waiting for the compass to "settle", which is necessary in all other makes of Compensating Binnacles in which the magnets are shifted in and out of holes in the base, or moved up and down on racks with fixed holes. After adjustment is finished, a record may be taken of the position of each magnet, as shown by a scale inside the Binnacle, and the record may be kept by the master for future refer ence; the adjusting key is then removed and the casing locked, making it impossible for any one to tamper with the magnets.

Our Binnacle also allows of closer adjustment than any other, as in it the position of magnets may be altered to a fraction of an inch when desired, which is impossible with Binnacles having holes in the base, or fixed racks for the magnets.

Our system of adjustment is fully protected by patents and can be used by no other maker.

The Binnacle is constructed in the most substantial manner, of the best material; the body is of well finished mahogany, mounted on a polished brass base; the hood is of strong brass, with two doors, front and back, to allow a bearing to be taken without removing hood; lift lamps; blinder; flinders bar; quadrantal correctors; and all magnets necessary for correction of largest errors.

Price, Complete, with Latest Improved 8-in. Card Ritchie Spirit Compass $200.00

This is the standard size and will be found suitable in most cases.

Special sizes made to order.

[SEE NEXT PAGE]

WE give below a partial list of Vessels which have been supplied with our Compensating Binnacles.

These Binnacles we can recommend as the best made, both in workmanship, finish, and principle of compensation. We guarantee them to give satisfaction in every case, or money refunded.

STEAMSHIPS

Ss. Advance	Ss. Yucatan	Ss. Oregon
" Mariposa	" Willamette	" Vigilancia
" Seguranca	" Shinnecock	" San Pedro
" Tacoma	" City of Augusta	" Nacoochee
" Orizaba	" Chattahooche	" Pilgrim
" Tallahassee	" Columbia	" Santa Rosa
" Kansas	" Walla Walla	" Admiral Sampson
" Umatilla	" Aswanley	" " Dewey
" City of Puebla	" El Norte	" " Schley
" San Pablo	" El Sud	" " Farragut
" Alameda	" El Cid	" Miami
" Reliance	" El Sol	" Laurada
" San Benito	" El Rio	" Horatio Hall
" Yumuri	" Finance	" S. T. Morgan
" Olivette	" Donato Guerra	" Anselm
" San Juan	" Grecian	" Porto Rico
" Pleiades	" Hawaiian	" Foxhall
" Hyades	" Sierra	" Indian
" American	" Ventura	" Proteus
" Comus	" Sonoma	

REVENUE CUTTERS

Walter Forward — Manning — McCulloch

STEAM TUGS

Paoli'	Nemasket	Catawissa	Geo. Pride
Winthrop	Lackawana	Tacony	Valley Forge
Eureka	Waltham	Charles Clarke	Lykens
Concord	International	Gettysburg	F. D. Richards,
J. B. King	Tamaqua	Swatara	Abram Minis
		Spartan	

STEAM PILOT BOATS

Philadelphia — Relief — New York

STEAM YACHTS

Dorothea	Josephine	Eugenia	Aileen
Atlanta	Oneonta	Alberta	Barracouta
Parthenia	May	Malay	Idelia

SHIPS

Tillie E. Starbuck — F. F. Oakes — Clarence Bement

BARKS

E. C. Mowatt

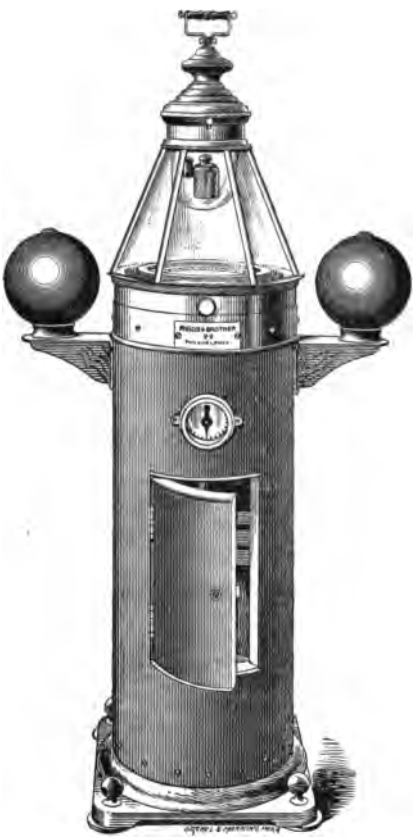
SCHOONERS

Red Wing — J. H. Edmunds

Imperial Japanese Cruiser Kasagi
Imperial Russian Cruiser Variag
Imperial Russian Battleship Retvizan

RIGGS' Improved Compensating Deck Binnacle

Showing Binnacle with hood off, for day use
Lamp may be removed

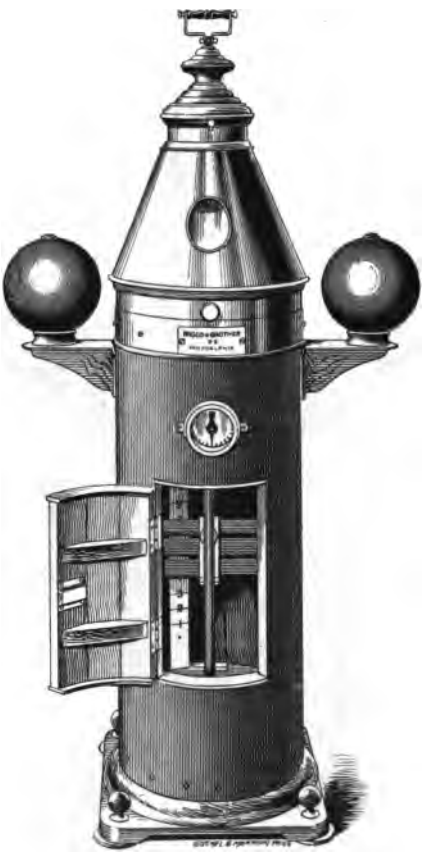


The above cut illustrates our latest improved pattern of Compensating Deck Binnacle. The stand is of finely finished mahogany, with solid brass base, the head of plate glass in brass frame, allowing the compass to be seen from any direction, and bearings to be taken without removing head; the lamp is central, and may be entirely removed during the day; when the hood is on, the flame of lamp cannot be seen, and the light illuminates the compass fully, without any glare in the eyes. The

This style of Binnacle is adapted for either Standard or Pilot House

RIGGS' Improved Compensating Deck Binnacle

Showing Binnacle with hood on, for night



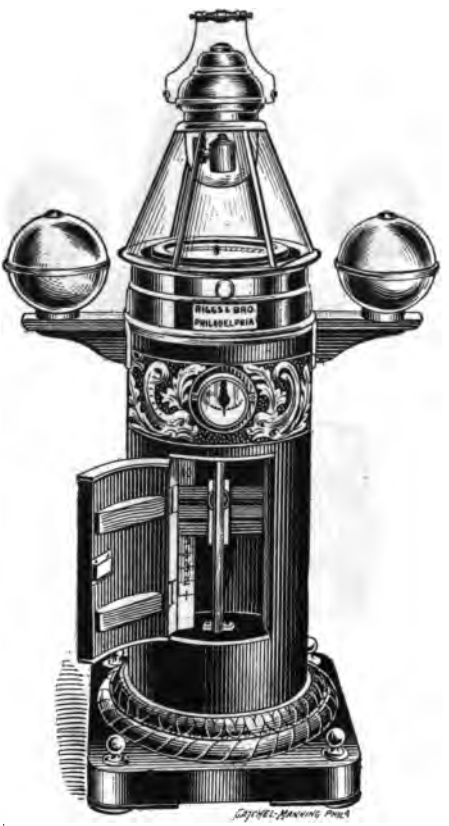
hood is in one piece, and may be turned to allow compass to be seen from any position. The Binnacle may be fitted to use either electric light or oil lamp. Each Binnacle is finished in the most substantial manner and furnished with deck plates, clinometer, flinders bar, quadrantal correctors and set of magnets.

Price, Complete, with 7-in. Ritchie Compass **$175.00**

This style of Binnacle is adapted for either Standard or Pilot House

RIGGS' Ornamental Compensating Yacht Binnacle

"EUGENIA" PATTERN



This Binnacle is the same as the one shown on page 115, but has a handsomely carved stand and the quadrantal correctors cased in brass.

Price, complete, with 7-in. Ritchie Compass **$200.00**

This is the regular size; other sizes made to order at short notice.

RIGGS'
Improved Yacht Binnacle

This Binnacle has the same style of head as the one shown on page 114, but without the compensating magnets and apparatus, being made just high enough for compass to swing in.

It is intended principally for use by sailing yachts.

The flange is of brass, and base of polished mahogany.

Price, complete with 7-in. Ritchie Compass . . $85.00

Size of base, 15 inches square. Height (from deck to top of lamp) 20 inches. This size kept in stock; other sizes made to order promptly.

NOTE. The height of flange can be made to suit.

RIGGS' Compensating Standard Binnacle

FOR DECKS

Stand is of finely polished Mahogany, Brass Head and Flange, Brass Base, Clinometer for finding Heeling Error, Quadrantal Correctors and Brackets, Flinders Bar, Heeling Magnets, and provided with every requisite for Perfect Compensation, &c.

Price, complete, with 6¾ Card Ritchie Compass **$150.00**

RIGGS'
..Compensating Binnacle..
FOR PILOT HOUSES

Size to take Ritchie Compass 7 in. Card	**$105.00**
" " " 8 in. "	**115.00**
" " " 9 in. "	**130.00**

This Price includes Compass.

This Binnacle is made of Mahogany, finely polished, with Heeling Magnets and Quadrantal Correctors.

LORD KELVIN'S

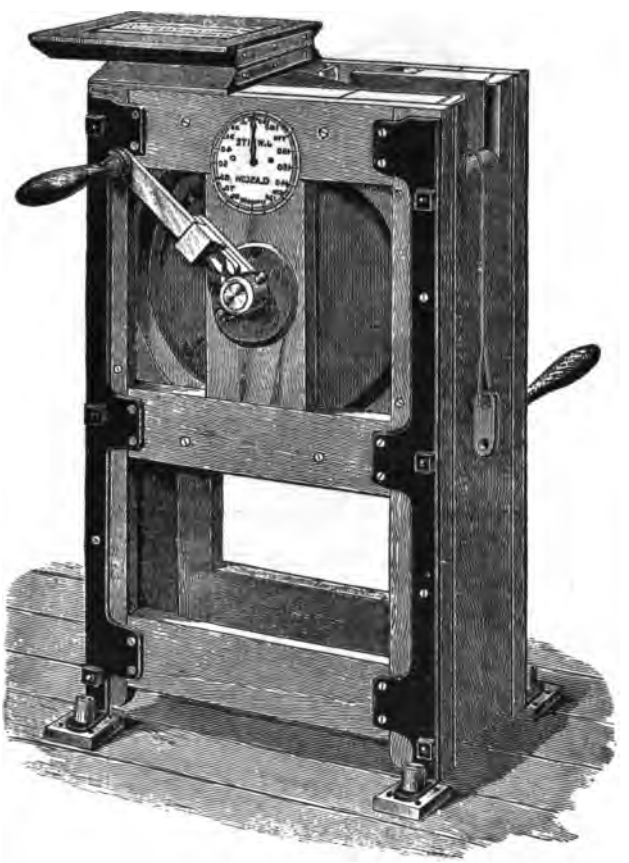
(Sir William Thomson's)

Compensating Binnacle

Binnacle and Compass Complete

Price, $275.00

LORD KELVIN'S (Sir William Thomson's) SOUNDING MACHINE



Sounding Machine Complete, Price, - - $175.00
Extra Glass Tubes, per 100 - - - - 40.00

Yacht Binnacle

MADE IN TWO SIZES

$65.00

*Height - - - -	36 inches
†Diameter - - - -	10 inches

$45.00

*Height - - - -	26 inches
†Diameter - - - -	7 inches

*Height from Deck to Top of Chimney.

†Diameter Bowl

BINNACLE

*Height . . . . . 47 Inches
†Diameter . . . . 13½ Inches

$100.00

*Height from Deck to Top of Chimney. †Diameter Bowl.

BINNACLE

*Height . . . . . 55 Inches
†Diameter . . . . 13 Inches

$95.00

*Height . . . . . 46 Inches
†Diameter . . . . 13 Inches

$90.00

*Height from Deck to Top of Chimney. †Diameter Bowl.

Binnacle Heads

No. OD. 13½ inches . . .	$52.00
No. 1. 12½ inches . . .	45.00
No. 2. 10¾ inches . . .	41.00
No. 4. 7½ inches, with Flange	45.00

Above prices, with exception of No. 4, do not include flanges or blinders.

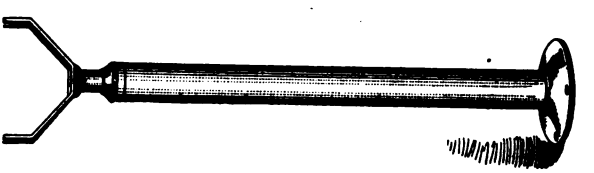
Brass Flanges, $10 to $15 extra
Blinders . . . $15 extra

Riggs' Improved Pelorus

$45.00

With this useful instrument Ship-masters can easily and quickly determine the errors of their Compasses. It can be used anywhere on deck. It is also very convenient for taking bearings, etc.

RIGGS' NEW PELORUS STAND



Stand and Yoke	$25.00
Extra Stand	15.00

DIRECTIONS

FOR USE OF THE

PELORUS

TO PLACE THE INSTRUMENT IN POSITION.

Have one or more stout, square table-tops or pillar-stands fitted on board in the best position for using the instrument; then place the instrument on each stand in succession exactly in a line with the ship's keel, and put four small chocks on the stand, so that the instrument can be readily dropped into its place at any moment.

TO FIND THE SHIP'S TRUE COURSE

Set and clamp the sights on the dial to the azimuth as given in the tables; then revolve the dial until the sun appears through the sights; the compass dial then indicates the true course of the vessel.

TO PUT THE SHIP ON A CERTAIN COURSE

Clamp the dial with the required course at the lubber line, and the sights to the azimuth as given in the tables, then swing the vessel round until the sun bears through the sights; the vessel is then on the course required.

TO TAKE THE ANGLE FROM THE SHIP'S HEAD

Clamp the sights exactly north on the dial, and revolve the dial until the object bears through the sights; the reading of the dial at the lubber line is the required angle.

YACHT BINNACLE

Polished **Mahogany**

9½ inches square; 12 inches high; Beveled Plate Glass Front.

Binnacle, with Lamp $15.00
Ritchie Compass for same (4 inch card) 20.00

Copper Boat Binnacle

(U. S. NAVY PATTERN)

This Binnacle is made of Copper, Japanned Black, is 7 inches square and 10 inches high, Dome Top and Bail Handle. It has a beveled-edge Plate Glass Front and Side Lamp.

Price, complete, with Lamp and Ritchie Compass, polished copper $40.00
" " " " " " " japanned black 32.00

LAUNCH BINNACLES

POLISHED OAK OR CHERRY

7 inches square ; 10 inches high.

Binnacle, with Lamp **$12.00**
Ritchie Compass for same (3-inch card) **16.00**

POLISHED MAHOGANY

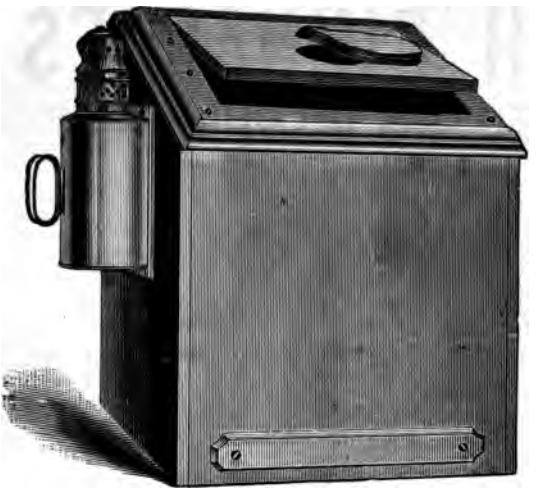
6¼ inches square ; 8 inches high.

Binnacle, complete, with Lamp, and 3-inch card liquid compass . . . **$18.00**

OAK OR CHERRY

5¼ inches square ; 7½ inches high.

Binnacle, with Lamp **$6.00**
Ritchie Compass for same (2-inch card) **7.50**
Brass " " " **3.50**



Square Binnacle Boxes

FOR

PILOT HOUSE

WALNUT

For No. OD Ritchie Compass $15.00
For No. 1 Ritchie Compass 12.50
For No. 2 Ritchie Compass 12.50

For sizes of Compasses, see page 132

ADJUSTABLE COMPASS READER

FITS ANY SIZE COMPASS

The advantages of this appliance are apparent at a glance. It magnifies the compass card and thus enables the small divisions to be easily read.

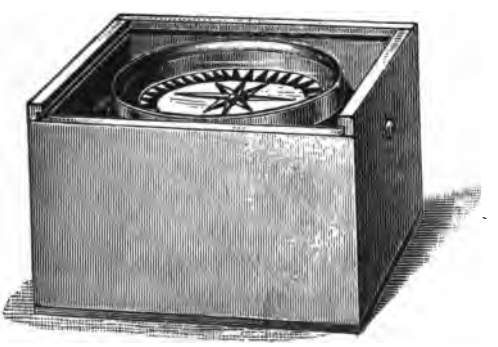
Price,$7.50

BRASS LAUNCH OR BOAT BINNACLE

Polished Brass, with Lift Lamp. Height, 12 inches; Diameter, 6½ inches.

Binnacle	$15.00
Ritchie Compass for same (3 inch card)	16.00

COMPASSES



10-inch Box, Gimbal Bell	$12.00
10-inch Box, Plain Heavy	8.00
10-inch Box, Plain Light	7.50
7-inch Box, Plain Boat	6.00
4-inch Box	3.50
3½-inch Box	3.00

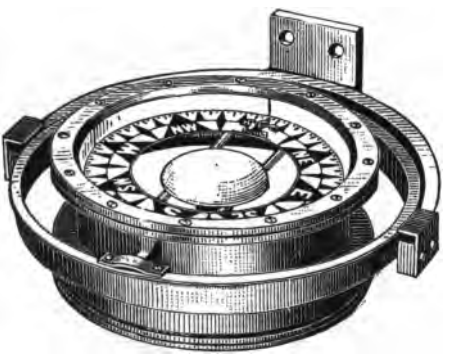
RITCHIE'S LIQUID COMPASS

FLAT CARD CENTRAL BUOY

				LIST PRICE.	RETAIL PRICE.
No. 0D size, 9-inch Card,	13¾	-inch diameter of	Box.....	$47.00	$38.00
" 1 " 8 "	12	"	"	39.00	31.00
" 2 " 7 "	11	"	"	32.00	26.00
" 3 " 5 "	9½	"	"	31.00	25.00
" 4a " 5 "	8¼	"	"	27.50	22.00
" 4 " 4 "	7¼	"	"	25.00	20.00
" 5 " 3 "	6½	"	"	21.00	16.00
*" 4 Boat Binnacle Compass, Japanned, with Side Lamp..				40.00	32.00
Baby size, 2-inch Card, 4¼	-inch diameter of	Box.....		10.00	7.50

* This Binnacle is made of Copper, Japanned Black, is 7 inches square and 10 inches high, Dome Top and Bail Handle. It has a beveled-edge Plate Glass Front and Side Lamp. See illustration on page 128.

Ritchie's Transparent Compass



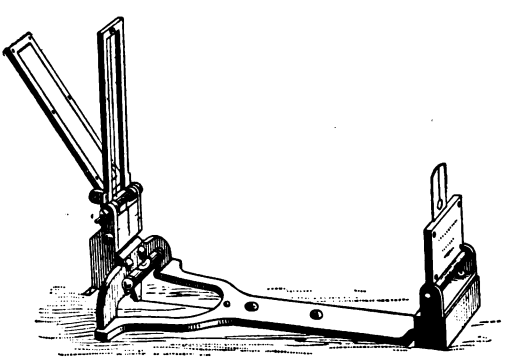
	LIST PRICE	RETAIL PRICE
7 inch Double Card, diam. of Gimbal ring $10\frac{3}{4}$	$44.00	$35.00
8 " " " " " " $11\frac{1}{2}$	50.00	40.00
9 " " " " " " $12\frac{1}{2}$	53.00	43.00

N. B.—This Compass can be read from above or below.

RITCHIE'S TELL-TALE COMPASS

	LIST PRICE	RETAIL PRICE
7 inch Card. Can be read only from below,	$43.00	$35.00
8 " " " " " " "	49.00	39.00
9 " " " " " " "	52.00	42.00

Either of the above can be furnished with Nickel plate at $5.00 extra.



Bar Azimuth Circle

Swung from pin fitting into a hole drilled in centre of compass glass. It is fitted for both sun and star observations, or for taking bearings . $30.00

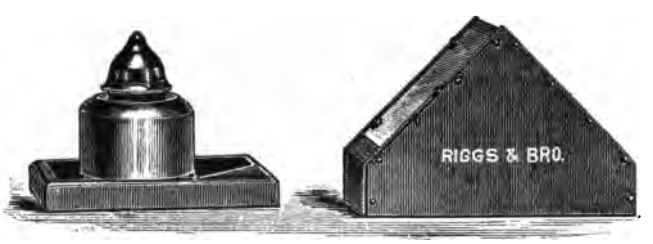
Riggs' Latest Improved Sextant

We recommend these instruments to those desiring a first-class Sextant for fine work. They are made with the greatest care, and attention to accuracy in every particular, and each one when completed is carefully tested at the celebrated Kew Observatory, and receives a first-class "A" certificate.

They represent the most modern improvements in the Sextant and we can confidently guarantee them to give satisfaction.

Price, with Kew "A" Certificate . . $125.00

ARTIFICIAL HORIZON



Complete with Mercury $30.00

SEXTANTS

Superior Sextants, with Kew "A" Certificates	$125.00
Superior Sextants, with Kew "A" Certificates	110.00
Superior Sextants, with Duplex "A" -	80.00
Superior Sextants, Cadet, 6½ inch - -	65.00

Octants and Quadrants

Our metal Octants and Quadrants (sometimes called Half-Sextants) are liked by all who have used them, and for ordinary purposes of navigation are preferred by many to the full Sextant.

They are handy and accurate and easy to read; the divisions are to 15″ on the Octants and to 20″ on the Quadrants; the Quadrants are preferred by most of our customers; for reliable instruments at a moderate price, they cannot be excelled.

Each instrument is put up in a neat, square, mahogany box, with the necessary telescopes and fittings.

No. 1, Octant, divided to 15″, on silver	$40.00
" 2, Quadrant, " 20″, "	34.00
" 3, " " 20″, "	30.00

GOERZ-TRIEDER BINOCULAR

These cuts show the inner construction of the new prism system in these powerful glasses. It will be seen that this fourfold reflection is the secret of the compactness of the glass, and also of its fine definition and power. This arrangement of prisms also admits of a large field of view, the stereoscopic effect enabling the observer to distinguish distant objects and their surroundings, under the same magnification as in ordinary telescopes of equal power, the arrangement in ordinary telescopes being such that the more powerful they become the smaller becomes the field of vision.

We can specially recommend the **Trieder Binocular**, being assured it will give entire satisfaction and will do all that is claimed for it.

SIZE No. 10.—Specially recommended for theatre and tourists' use. Has large field of view. 3 Power. **Price, $36.00.**

SIZE No. 20.—"Universal;" is practical for any purpose. 6 Power. **Price, $46.00.**

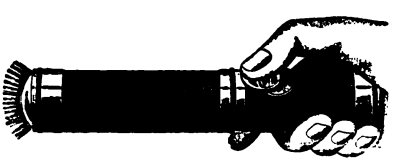
SIZE No. 30.—This glass is recommended for tourists and for use at the race-course. 9 Power. **Price, $54.00.**

SIZE No. 40.—The extreme magnifying power of this glass renders it useful for all occasions where a distinct image of objects at great distance is required. It is the best glass for use in the army and navy, or at races and regattas, but is not suitable for the theatre or the hunting field. 12 Power. **Price, $62.00.**

"EVER READY" ELECTRIC LIGHT

No Wires **No Smoke or Smell**

NO DANGER, **No Striking Matches**



Simplicity itself. A child can operate it. Useful for all purposes where a light is required instantly. Can be carried into a cellar full of leaking gas, into an oil tank, into alcohol or malt vats, or placed in a keg of gunpowder without the slightest danger.

Best Quality, Ebony Finish, Silver Reflector, Polished Nickel Trimmings

No. 4.—1½ x 8½ inches. **Price, $3.50**

Extra Battery, 30 cents. Will give 4000 to 5000 lights before battery requires renewal.

No. 6.—1½ x 13 inches. **Price, $5.50**

Extra Battery, 50 cents. Will give 4000 to 5000 lights before battery requires renewal.

MARINE GLASSES

Aluminum	$12.00 to $38.00
Fair Quality	6.00 to 12.00
Good Quality	15.00 to 20.00
Best Quality	22.00 to 40.00

The "Neptune" Day Glass is the result of our many years of experience in Marine Glasses, and we believe combines more desirable features than any other Marine Glass on the market. It is of medium size (length closed 5¾ inches), good power, fine definition and large field; for every day use on board ship it cannot be excelled. Many glasses for which higher prices are charged will not give as much satisfaction as the "Neptune."

Made in two sizes (24L and 26L object glasses) and in aluminum and metal frames.

Aluminum frames, 26L	$38.00
" " 24L	35.00
Metal " dark bronze finish, 26L	22.00
" " " " " 24L	21.00

Price includes case and strap with each glass.

NIGHT GLASSES

Fair Quality	$9.00 and $10.00
Good Quality	13.00
Best Quality	15.00

Our "Pilot" is the best combined day and night glass made. Short model, wide eye pieces, with side screens to eye pieces $15.00

Price includes case and strap with each glass.

OPERA GLASSES

Leather	$ 3.00 to $10.00
Aluminum	10.00 to 15.00
Pearl	3.50 to 16.00

Ship and Yacht BELLS

SUPERIOR TONE

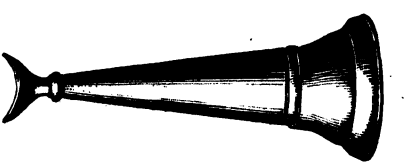
10 inch, polished	$20.00	6 inch, polished	$ 5.00
8 inch, "	9.00	10 inch, not polished	15.00
7 inch, "	6.00	8 inch, "	7.50

TELESCOPES

Fine Quality	$12.00 to $15.00
Superior Quality	16.00 to 20.00
Best Quality	25.00 to 40.00

TRUMPETS

BRASS OR NICKEL



17 Inch, Brass	$2.25
17 " Nickel	3.00

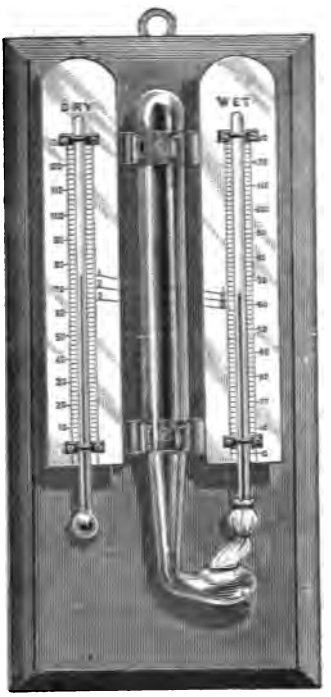
BOATSWAIN'S CALL

Sterling Silver	$4.00
German Silver	1.00
Echo Calls	.25

75c. $1.00 to $2.50 $1.25

ANEROID BAROMETER

8–inch	Metal	Dial,	Open,	1	Thermometer	$20.00
6 "	"	"	1	"		17.00
5 "	"	"	1	"		15.00
3½ "	"	"				13.00
5 "	"	Closed				12.00
5 "	"	"				9.00
5 "	"	"				8.00
5 "	Porcelain,	"				9.00
3½ "	"	Dial,	Open			7.00
Cheaper Barometers as Low as						2.50



Mason's Hygrometer

Wet and dry bulb Thermometers mounted on polished oak or cherry frame; sizes 10½ by 4¾ inches; scales raised from scale by insulating straps; water bottle in centre . $3.50

THERMOMETERS

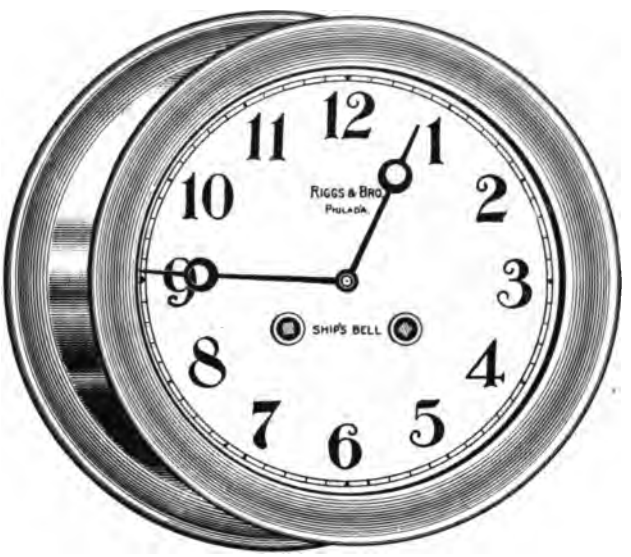
COPPER AND JAPAN

8-inch	Japanned Tin Case, common	$ .15
8 "	" " " with "storm glass"	.25
10 "	" " good quality	.75
10 "	Copper Case	1.50
10 "	" " "Water Boils" scale	1.75
12 "	" "	2.00
12 "	" " "Water Boils" scale	2.25
12 "	" " extra wide	2.25
12 "	" " " " "Water Boils" scale	2.75
10 "	Japanned Tin Case, maximum and minimum	3.00

Cabin or House Thermometers, on wood backs, in various styles.....from 30c. to 4.50

EIGHT DAY

Ship's Bell Clock



Strikes Ship's Bells one to eight, on fine Cathedral gong, with soft, deep tone. Hands may be turned backward or forward without disarranging the striking; the clock will always strike the hour shown by the hands. The case is solid cast brass; fine eight day movement with jeweled escapement and compensation balance.

4½-inch dial	$38.00
6 " "	42.00

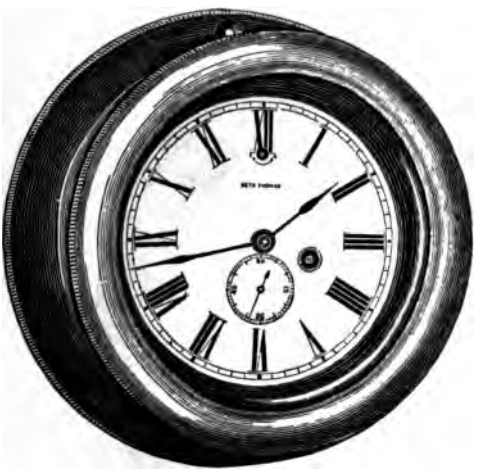
SHIP'S BELL CLOCK

ONE DAY.—Nickel Case

Strikes the Ship's Bells from One to Eight

Price, $7.00

CLOCKS



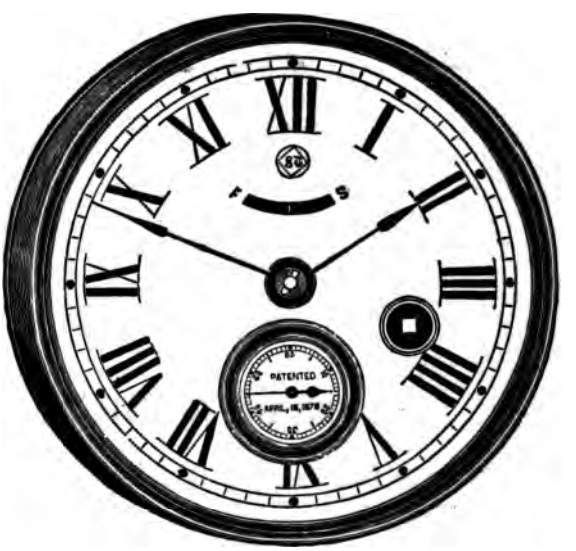
Chronometer Lever

Fine eight-day lever movements, with jeweled escapement and compensation balance. In Solid Brass Cases, finished POLISHED BRASS, or the same NICKELED. In ordering state which finish is wanted.

Regular stock sizes are as below stated; other sizes and styles of cases to order.

4½ inch Screw Bezel	$18.00
6 inch Hinged Bezel, lock and key	23.00
8½ " " " " " "	29.00
10 " " " " " "	36.00
12 " " " " " "	42.00

ENGINE LEVER BRASS or NICKEL



1-Day - $4.00
8-Day - 6 00

BANNER LEVER

BRASS OR NICKEL

1-Day, 6-inch,	$4.00
1 " 8 "	5.50
8 " 6 "	6.00
8 " 8 "	7.00

Rosewood, Walnut Mahogany

1-Day, 6-inch	$3.50
8 " 6 "	5.50
8 " 8 "	6.50

The Navy Lever Clock

Polished nickel case. Winds and sets from side of case, without removing face.

8 day, 3-inch dial.....$5.50

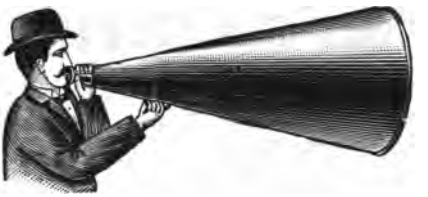
Width across back, 4¾ inches.

This is a neat and handsome clock for yachts or state rooms.

THE CABLE LEVER CLOCK

Case of dark or light wood

1	day,	4-inch	dial		$2.50
1	"	6	"	"	3.50
8	"	6	"	"	4.50
1	"	8	"	"	4.00
8	"	8	"	"	5.00



Stentor Megaphones

Will carry and receive the voice to and from a distance of one or two miles. Used on vessels, at races, athletic games, shore cottage, country home, and any place where the voice cannot be easily heard, and to locate sounds in a fog.

No. 1, 15-inch	$1.50
No. 2, 30-inch	2.50
No. 2½, 34-inch	3.00
No. 3, 40-inch	3.50
No. 4, 56-inch	5.00
No. 7, 60-inch	8 00
18-inch Aluminum Megaphone	3.00
34-inch Aluminum Megaphone	8.00

BE SURE YOU GET A STENTOR

12-inch Junior Megaphone	$0.25
20-inch Junior Megaphone	.50

Used for cheering, etc.

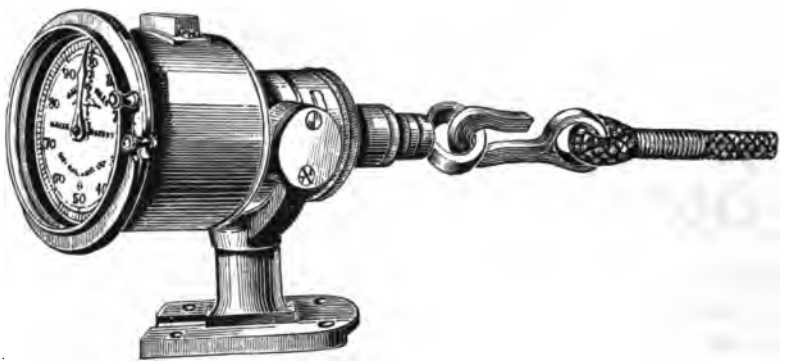
Stentor Megaphones are made from the best quality of chemical and fibre boards, and are finished with two coats of spar varnish, making them impervious to moisture. All metal parts are brass, nickel plated, so that Stentor Megaphones can be carried in the wheelhouse of a vessel without danger of attraction to the compass. (Megaphones having iron parts are objectionable on this account.) The mouthpiece is seamless and is attached by a patented process. The color of the smaller sizes is a rich mahogany, of sizes four and seven, light terra cotta. The greatest care is taken with workmanship and finish, resulting in a megaphone without equal.

RIGGS & BROTHER

310 Market Street **Philadelphia**

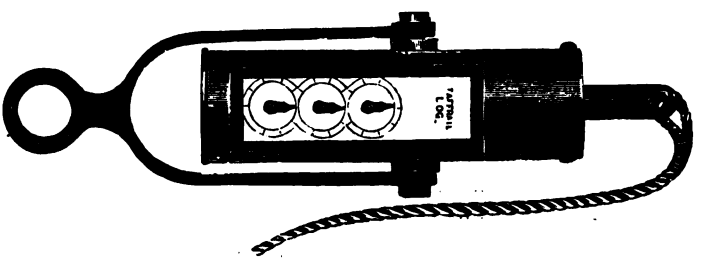
BE SURE YOU GET A STENTOR

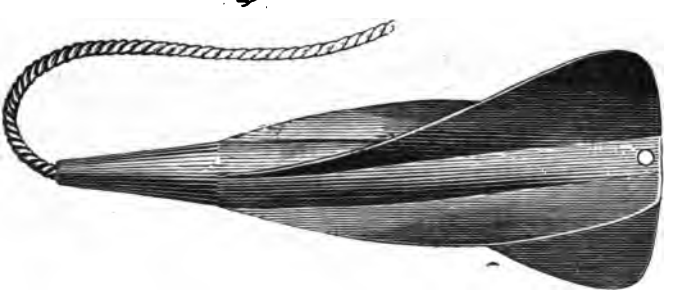
Walker's Cherub Log



With (2) Rotators and Line	$35.00
Extra Rotators	7.50
Extra Lines	5.00

Taffrail Log





Complete	$20.00
Extra Rotator	4.00
Extra Line	2.00

Negus Taffrail Log, complete	27.00
Bliss " " "	22.00
Merrill " " "	18.00

Side Lights

Mast Head

Anchor Lights

Deck Lanterns

Bull's Eye Lanterns

Club Boat Lanterns

Binnacle Lamps

Estimates given for all kinds of LAMPS

ESTABLISHED 1818

RIGGS & BROTHER

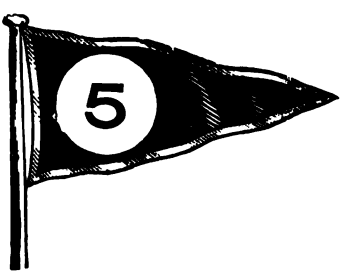
DEALERS IN

Diamonds
Watches
Clocks
Jewellery
and
Silverware

MANUFACTURERS OF

Solid Gold Harbor Badges

$2.50
Each



$2.50
Each

ANY HARBOR ENAMELED IN COLORS

310 Market Street, - Philadelphia

Established 83 Years.

Watches

WE call the attention of Captains and others, desirous of purchasing Watches, to our large stock of both ***American*** and the finer grades of ***Foreign Watches.***

We have constantly on hand a Large Stock of all Grades, in every variety of Cases, and as the number sold by us enables us to purchase them at the ***lowest rates,*** we offer them to our customers at very ***moderate prices.***

We make a specialty of ***moderate-priced American Watches,*** in Gold, Gold Filled and Silver Cases, and every Watch we sell is guaranteed free from all defects, and to give satisfaction.

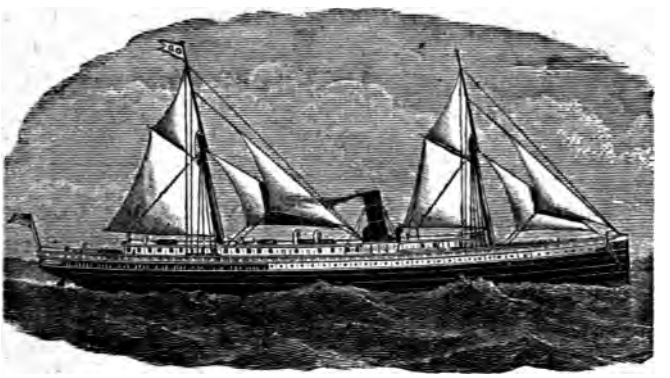
Gentlemen's Gold Watches, $25 to $250
Ladies' Gold Watches, $14 to $125
Gentlemen's Gold Filled Watches, $8 to $35
Ladies' Gold Filled Watches, $10 to $20
Gentlemen's Silver Watches, $6 to $40
Ladies' Silver Watches, $4 to $20
Nickel Watches, $2.50 to $6

RIGGS & BROTHER

310 Market Street Philadelphia

ESTABLISHED 1874

Cable address, "REESE" Telephone 2806



JOHN REESE

Ship Chandler and Grocer

Dealer in all kinds of

SHIP AND STEAMSHIP SUPPLIES

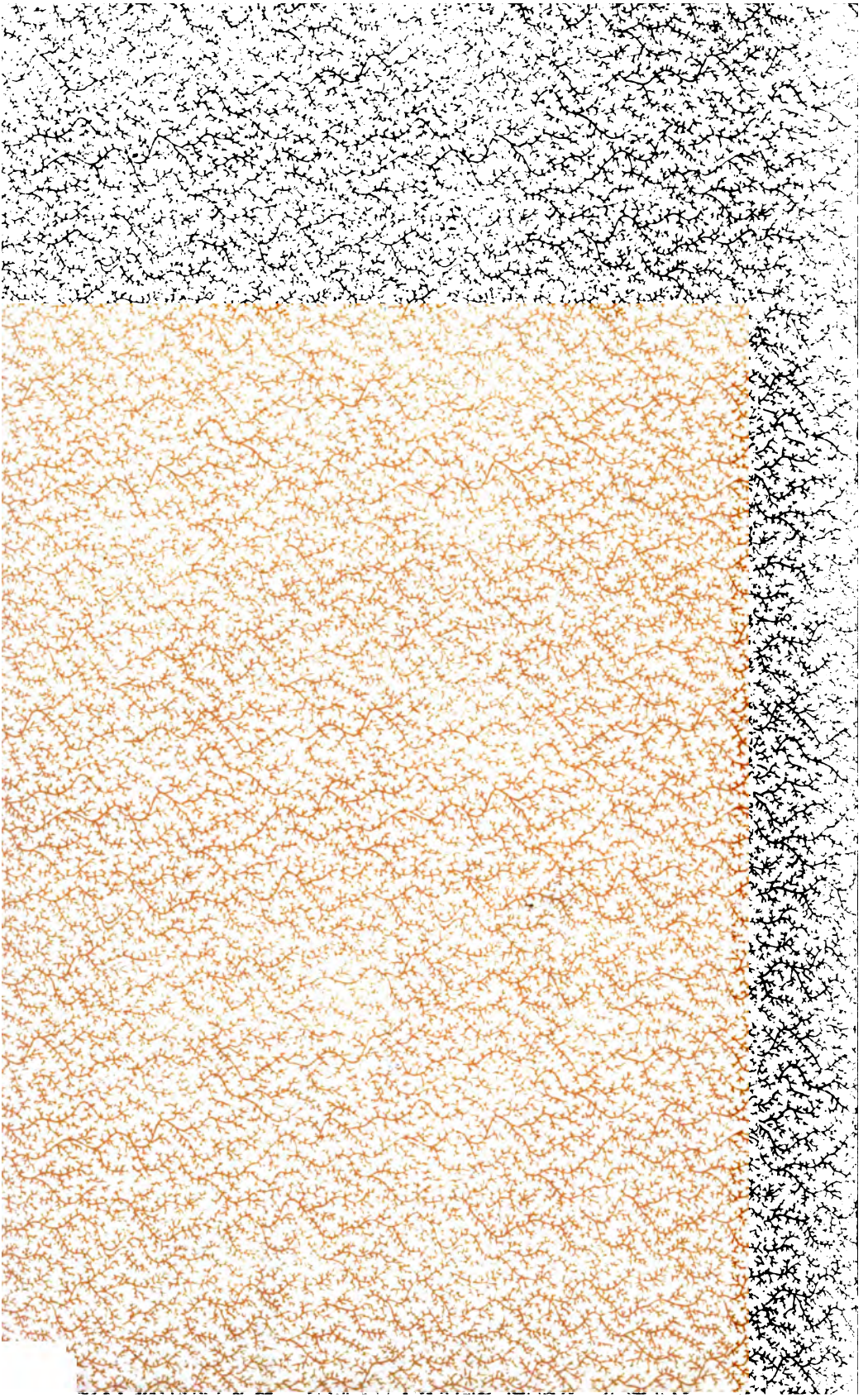
No. 217 SANSOM STREET

PHILADELPHIA

AGENT FOR

Reynold's Patent Oil Bag

P. S.—Ships' Letters addressed to my care delivered promptly on board, on arrival of vessel.



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